AIR POLLUTION
REGULATION 308

APPENDICES A - G

November, 1987

Environment
Ontario

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Air pollution regulation 308.

APPENDIX A

SUMMARY OF

CLASSIFICATION PARAMETERS

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INTRODUCTION

An approach has been developed that identifies the level of control technology required for air contaminants. A concern level for a chemical in the environment is used to classify the chemical and thereby determine the level of control required.

The following generally accepted parameters have been developed to determine the concern level for a chemical in the environment. These parameters are a subgroup of the parameters in a methodology being developed for the Ministry of the Environment for assessing the relative environmental hazards of chemical contaminants. The magnitude of the score assigned to each parameter reflects the level of concern arising from that property of a chemical.

1. Environmental Behaviour Parameters

Range of scores: 0-10 for all parameters a. to c. except Environmental Transport which is 0-4.

a) Environmental Transport
b) Environmental Persistence
c) Bioaccumulation

2. Toxicity Parameters

Range of scores: 0-10 for all parameters a. to g.

a) Acute Lethality
b) Sub-Lethal Effects on Non-Mammalian Animals
c) Sub-Lethal Effects on Plants
d) Sub-Lethal Effects on Mammals
e) Teratogenicity
f) Genotoxicity/Mutagenicity
g) Carcinogenicity

In addition to the numerical value assigned to a parameter, various symbols are used to indicate special concerns regarding the source of, or confidence in, the underlying data:

- If the data required are not available, an asterisk (*) is assigned to that parameter rather than a numerical score.

- If the data used are questionable (e.g., data lacking in documentation, data derived with outdated methods), a score is assigned to the parameter, but it is "tagged" with a question mark (?) to indicate doubt regarding the confidence in the data.

- If the data used are perceived as representing a worst-case scenario (e.g., toxicity data from intravenous administration), the score for that parameter is "tagged" with an exclamation mark (!).

- If the data used in the assignment of a parameter score are estimated from environmental modelling techniques or structure-activity relationships, the score for that parameter is "tagged" with a superscript "e".

These "tags" may be taken into consideration when the magnitude of the scores are used to decide on the level of control technology.

Table 1 below shows some hypothetical examples of how various scores would lead to different levels of control technology.

TABLE 1

LEVELS OF CONTROL TECHNOLOGY

	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6	Ex.7
Environmental Behaviour							
Environmental Transport	3	*	4[e]	2	3[e]	3	2[e]
Environmental Persistence	7	*	7[e]	*	7[e]	7	7
Bioaccumulation	7	*	10	7	10	7	4
Toxicity Parameters							
Acute Lethality	6	10	6	7	6!	4	4
Sub-Lethal Effects on Non-Mammalian Animals	*	7	*	7	*	*	*
Sub-Lethal Effects on Plants	*	5	*	*	*	4	*
Sub-Lethal Effects on Mammals	*	*	7?	*	*	4	*
Teratogenicity	*	*	*	*	*	*	*
Genotoxicity/Mutagenicity	8	8	7	8	4?	4	4
Carcinogenicity	10	8	*	*	6	*	*
TOTAL COMBINATION SCORE (IF APPLICABLE)	NA	NA	21	NA	19	14	13
APPLICABLE LEVEL OF CONTROL TECHNOLOGY	1	1	1	2	2	2	3

NA - Not applicable

PARAMETERS

1. Environmental Behaviour Parameters

(a) ENVIRONMENTAL TRANSPORT

Rationale

This parameter describes the transport of chemicals between environmental media. The environmental transport of a chemical is an important factor in evaluating its potential environmental and health hazards. Inter-media transport can be observed during field studies or by undertaking microcosm studies in a laboratory, but relatively few substances have been studied using such techniques. One way to estimate the environmental transport characteristics of a chemical is to use a simple mathematical model such as the Fugacity Level II model.

The Fugacity Level II model estimates the equilibrium distribution of a chemical released to the environment. The environmental media considered are air, water, soil, sediment and biota. The model requires information about both the chemical and receiving environment. The necessary chemical properties are molecular weight, solubility, vapour pressure, and the octanol-water partition coefficient. Approximate constants for key environmental processes and an estimate of overall environmental half-life are also needed. Each of the environmental media must be characterized. These characteristics are influenced by the size of the area being considered (MacKay and Paterson, 1981).

Environmental mobility can also be indicated by parameters such as solubility and vapour pressure. These parameters are widely reported in the literature and can be found with relative ease for most chemicals. The water solubilities of most common organic chemicals fall in the range of 1 to 10^5 g/m^3 (Lyman et al., 1982). Highly soluble substances are relatively mobile in surface and ground waters

and tend to be more biodegradable than those with low solubility. The scores in this parameter are directly proportional to solubility on the basis that as solubility increases so too does the potential migration and exposure via aquatic pathways. Other parameters address persistence and other undesirable characteristics of the less soluble substances.

Vapour pressure is a measure of volatility and is important in evaluating air exposure pathways. Vapour pressure of liquids ranges from 10^{-4} to 10^{2} kPa and solids range down to 10^{-8} kPa (Lyman et al., 1982). Vapour pressure can be estimated from other physical characteristics (for examples see Lyman et al., 1982).

Scoring Criteria

The criteria for this parameter use results from environmental models and/or individual parameter values. In addition, there are criteria for substances that are largely associated with fine particles (generally less than 10 um in size). Examples are fine particles associated with incinerator processes.

The scoring criteria for this parameter are as follows:

PARAMETER SCORE	CRITERIA
4	At least two media other than the receiving medium, each containing more than 20% of the chemical released; OR the vapour pressure is greater than 1 kPa and water solubility is greater than 100 g/m^3; OR most of the chemical is associated with fine particles when released into the environment.
3	One or more media other than the receiving medium, each contain 10% to 20% of the chemical released; OR either the vapour pressure is greater than 1 kPa or water solubility is greater than 100 g/m^3.
2	One or more media other than the receiving medium, each contain 5% to 10% of the chemical released; AND the vapour pressure is 1 kPa or less and water solubility is 100 g/m^3 or less.
0	Less than 5% of the chemical released partitions into media other than the receiving medium; OR the vapour pressure is 1 kPa or less and water solubility is 100 g/m^3 or less.

Suggested Information Sources

Lyman et al., 1982 -

A comprehensive reference of published values and estimation methods for various physical and chemical properties.

Verschueren, 1983 -

A handbook of environmental data for organic chemicals.

ENVIROFATE and ISHOW databases -

Contain solubility, vapour pressure, partition coefficients for many chemicals.

ICF Inc., 1985 -

Contains tabulations of physical, chemical and fate data for many organic substances and elements.

Mills et al., 1982 -

A compilation of physical, chemical and fate data for many organic substances.

Mackay and Shiu, 1981 -

A compilation of physical and chemical parameters for organic substances.

Kenaga and Goring, 1980 -

A compilation of solubility, sorption and K_{ow} data.

Clayton and Clayton, 1981 -

A comprehensive reference of information on industrial chemicals.

Karickhoff, 1984 -

Discussion of sorption processes in general and K_{ow}/K_{oc} values in particular.

Amoore and Hautala, 1983 -

Information on volatilities of industrial chemicals.

Neely and Blau, 1985 -

Contains physical, chemical and fate data and estimation methods.

(b) ENVIRONMENTAL PERSISTENCE

Rationale

This parameter describes the tendency for a chemical to persist in the environment. Substances in the environment can be subjected to a variety of processes including sorption, oxidation, hydrolysis, photodegradation and biodegradation. The net result of such processes may be expressed as the overall persistence of a substance in the environment. When quantified, persistence is usually expressed as the length of time required for one-half of the original amount of a substance to be degraded. It is analogous to parameters which may be presented as "rate of loss in natural systems", "overall half-life", or "50% recovery time". It is also similar to the "persistence" parameter calculated by fugacity models.

Half-lives of chemicals may vary from seconds to thousands of years (ICF Inc., 1985). Short half- lives generally indicate a lower level of concern. For example, environmental releases of substances with half-lives of less than a few days often will not result in significant accumulation in the environment. Conversely, those with half-lives of several months or longer can lead to substantial exposure or accumulation in the food chain.

Scoring Criteria

The criteria for this parameter are based on half-life values or on general descriptors of persistence. If scores can be assigned using both quantitative and qualitative criteria, the higher score should be used.

If half-life data are available, they will usually pertain to specific media as opposed to general environmental persistence. This information provides an indication of levels of concern regarding

specific media. In such cases, it is recommended that the media providing the highest score be used.

If persistence values have not been reported and cannot be estimated by using environmental models, other types of information may offer guidance in developing a score for this parameter. For example, structure-activity relationships (SARs) may provide general indications of persistence for relatively unknown substances structurally similar to more familiar substances. To assess the potential biodegradability of substances in wastewater treatment plants, test methods such as the static-culture-flask and shaker-flask techniques have been used (for example, see Tabak et al., 1981). The results of these tests in general show good agreement with published work on biodegradability. Substances not degraded under test conditions cannot be presumed to be immune to microbial action in the environment. Accordingly, scores derived from SARs or biodegradability tests should be tagged with a superscript "e", a question mark, or exclamation mark as appropriate.

PARAMETER SCORE	CRITERIA
10	Half-life greater than 100 days; OR designated as very persistent
7	Half-life of more than 50 but less than or equal to 100 days; OR designated as moderately persistent.
4	Half-life of more than 10 but less than or equal to 50 days; OR designated as slightly persistent.
0	Half-life of less than or equal to 10 days; OR designated as not persistent

Suggested Information Sources

ICF Inc., 1985 -

Includes compilation of half-lives in several media for organic substances.

Mills et al., 1982 -

Includes compilation of half-lives in aquatic media for organic substances.

Verschueren, 1983 -

Includes half-lives and biodegradability test results for organic substances.

NRCC - National Research Council of Canada Associate Committee on Scientific Criteria for Environmental Quality - These publications include data on biodegradability for specific substances.

ENVIROFATE database -

Contains data on biodegradation rates for chemicals released to the environment.

Tabak et al., 1981 -

Includes results of biodegradability studies for more than 100 organic substances.

(c) BIOACCUMULATION

Rationale

This parameter describes the tendency for a substance to accumulate in biological systems. In the current context, the term bioaccumulation is intended to convey the ability of a substance to accumulate in the tissues of organisms. The tendency for certain groups or classes of chemicals to bioaccumulate is well documented. This process has also been referred to as bioconcentration or biomagnification. Some authors have assigned various distinct definitions to these terms but for purposes of this assessment those differences are relatively unimportant.

One of the parameters frequently used to express bioaccumulation is the bioconcentration factor (BCF). Most BCF values pertain to fish or other aquatic organisms and are calculated as the ratio of the concentration of a substance in the organism (or some specific tissue) on a wet weight basis to the concentration of the substance in the water at steady state (Veith et al., 1980). For organic substances, values of BCF range from about 1 to more than 1,000,000 (Lyman et al., 1982).

Bioaccumulation factors have also been determined for some terrestrial vertebrates but these data are less abundant and more difficult to locate than those for aquatic organisms. It is recommended for this assessment that data collection efforts first focus on BCF values for aquatic organisms.

The tendency of substances to bioaccumulate in tissue frequently has been related to hydrophobicity or lipophilicity (Veith et al, 1980). As a result, various regression equations have been suggested for predicting BCF values for aquatic organisms based on the octanol-water partition coefficient (K_{ow}) and other physico-chemical properties. To date, those that use K_{ow} values have been the most widely investigated and most successful (Lyman et al., 1982; Geyer et al., 1984).

Scoring Criteria

Scoring criteria for this parameter are defined in terms of either BCF or log K_{ow}. The correlation between the two sets of criteria is based upon the following relationship developed from experimental data on 84 chemicals (Veith et al., 1980):

$$\log BCF = 0.76 \log K_{ow} - 0.23$$

Other equations have been developed based upon various groups of chemicals. If an equation directly applicable to a substance being evaluated is available, that equation can be used.

The bioaccumulation of compounds with relatively high K_{ow} values is influenced by the degree to which a compound dissociates in water. Equations for estimating bioaccumulation that include a dissociation term have not been reported. For this parameter, dissociation has not been considered in the determination of scores. This should tend to produce somewhat higher scores than warranted for some organic substances. BCF values can be estimated only to within an order of magnitude using most of the correlations developed to date, and

laboratory test situations are incapable of duplicating field situations (Lyman et al., 1982). Therefore, the consideration of dissociation effects may be unimportant for this evaluation.

If scores based on both the BCF and the K_{ow} can be determined, preference should be given to the measured BCF values rather than those estimated based on K_{ow}.

PARAMETER SCORE	CRITERIA BCF	log K_{ow}
10	>15000	>6.0
7	>500 - 15000	>4.0 - 6.0
4	>20 - 500	>2.0 - 4.0
0	$\leq$ 20	$\leq$2.0

Suggested Information Sources

Lyman et al., 1982 -

Contains BCF and K_{ow} data and estimation methods.

Geyer et al., 1984 -

Examines relationship between BCF and K_{ow}.

Kenaga and Goring, 1980 -

Includes K_{ow} and BCF data for aquatic environments.

Verschueren, 1983 -

Includes BCF and K_{ow} data for organic substances.

Veith et al., 1980 -

Includes BCF and K_{ow} values.

AQUIRE database -

Contains BCF data for aquatic organisms.

Mackay, 1982 -

Examines correlations of BCFs.

Garten and Trabalka, 1983 -

Contains BCF data for aquatic and terrestrial organisms.

ICF Inc., 1985 -

Includes BCF data.

Hansch and Leo, 1979 -

Describes how to estimate K_{ow} values.

2. Toxicity Parameters

Parameters "a" through "g" were selected to describe the toxicological properties of chemicals. Information on acute lethality of chemicals to all targets in the environment is included in parameter "a". The sub-lethal effects of chemicals on ecological systems (plants and animals) are described in parameters "b" and "c". Parameters "d" through "f" are primarily designed to describe potential adverse effects on human health.

When data are lacking on the effects of a chemical on a specific environmental target (e.g., humans, fish or wildlife) the best available information should be used. Unless specific data are available on species differences in response to the chemical, it is assumed that all species respond in an equivalent manner and the most sensitive would be used in scoring. Differences in response among species, or other differences between experimental and "real-world" exposure situations (e.g., data from high level experimental exposures

extrapolated to much lower levels) are not considered in this assessment.

There are several general topics, including route and duration of exposure and validity of testing procedures, that apply equally to all of the toxicity parameters. These are discussed below and will only be briefly referred to in the descriptions of each parameter.

Route of Exposure

Route of exposure is an important factor in the judgement of the applicability and validity of the effects observed under controlled experimental conditions (Grice, 1984; Willes et al., 1985). In terrestrial animals, oral, inhalation and dermal routes of exposure are considered the most representative of "real-world" exposures. In aquatic species, the usual route of exposure is through water. In plants, exposures usually occur through soils or from the atmosphere. In all test systems, data derived by direct application of chemicals to biological systems (e.g., direct injections into tissues) that by-pass normal absorption and uptake systems may indicate the potential for the production of adverse effects, but their relevance to normal exposures should be carefully evaluated. In addition, the use of vehicles (e.g., dimethylsulfoxide) in dermal exposure studies can substantially increase the uptake of chemicals through the skin and, although the results would indicate a worst-case assessment of potential effects, their relevance to usual dermal exposure is questionable. In all of the toxicity elements the scorer must exercise judgement in the use of data derived from unusual exposure routes. If such data are the only information available they may be used but, at the very least the scores assigned require appropriate "flags" (e.g., ? or ! or "e").

Duration of Exposure

The duration of exposure is important in the assessment of potential effects of chemicals on the environment and health (Hushon and

Kornreich, 1984). Acute lethality is usually assessed following a single exposure (e.g., LD_{50}, LC_{50}), or following a short duration of exposure (e.g., acute tolerance tests or 96-hour LC_{50} tests in aquatic species). The assessment of long-term effects usually involve multiple exposures for the major portion of the lifespan of the test system (FDA, 1982). This is usually considered a minimum of one year in terrestrial animals (FDA, 1982), but may be as short as a few days in certain short-lived aquatic and plant test systems.

In the assessment of long-term effects of chemicals, judgement is required to determine if the duration of exposure and observation in the studies was adequate both to achieve a steady state level of the chemical in the system and to encompass the latency period for the development of adverse effects. The biological half-life of the test chemical can assist in judging whether steady state levels of the chemical in the test system were achieved. For example, a minimum of 3.5 half-lives are generally required to reach 99% of the steady state body burden (FDA, 1982; Willes et al., 1985).

The latency period between the initiation of exposure and the development of particular adverse effects depends on the type of effects produced, in addition to the time required to achieve a steady state body level. Effects related to general narcotic actions of chemicals generally have much shorter latency periods (e.g., several hours) compared to cancer where latency periods range from months to years (Grice 1984; Willes et al., 1985).

If adequate long-term exposure data are not available, scores for toxicity elements addressing long-term effects may be estimated from shorter term exposure data. In terrestrial animals, data from exposures of 90+ days may provide reasonable estimates of certain long-term effects, although the validity of extrapolating such data to predict chronic effects requires considerable judgement. Judgement is even more critical when estimates of potential chronic effects are made by extrapolation of data from various short-term in vivo or in vitro

test systems (Grice, 1984; Willes et al., 1985). It is not possible nor desirable to overly complicate a scoring system by incorporating all the uncertainties of extrapolating data from shorter to longer exposure scenarios. Therefore, as a general rule, when effects related to long term exposure are estimated from short-term exposure data, the scores derived require appropriate "flags" (e.g., !, ? or "e") indicating uncertainty in the assigned score.

Validity of Testing Procedures

The assignment of scores to the various toxicity parameters requires that the scorer assess the validity of the procedures followed in the collection of the toxicological data. It is beyond the scope of this scoring system to provide details of adequate procedures for the myriad of ever- changing tests available. The following references outline current standard procedures used in the collection of toxicological data: Grice et al., (1975); IARC (1980); FDA (1982); EPA (1984); NTP (1984); OSTP (1985). The validity of new testing procedures can usually be determined from publications by recognized authority centres around the world (e.g., Health and Welfare Canada, U.S. EPA, U.S. FDA, WHO, OECD, IARC).

(a) ACUTE LETHALITY

Rationale

This parameter describes the acute lethality of chemical to terrestrial and aquatic animals. Non-lethal or reversible effects are not included in this element.

Acute effects other than lethality (e.g., irritation, allergic reactions, general narcosis, etc.) are considered in other toxicity elements. Criteria for phytotoxicity are not included in this element because of the difficulties in assessing lethality in plants.

Scoring Criteria

Scoring criteria for acute oral and dermal LD_{50}s and inhalation and aquatic LC_{50}s are similar to those utilized by the Transportation of Dangerous Goods Act (DOT, 1984) and the State of Michigan Critical Materials Registry (Michigan, 1979). Scores of six down to zero for oral and dermal LD_{50}s are comparable to the extremely toxic to relatively non-toxic scales outlined in the literature (Hodge and Sterner, 1949; Gleason et al., 1977; Doull et al., 1980). The criteria for scores of 8 to 10 would identify chemicals with greater toxicity than those included in the scales referred to above. These more stringent criteria were adopted to ensure chemicals with extreme acute lethality are clearly identified by the scoring system.

The scoring criteria for inhalation LC_{50}s are derived from the oral LD_{50} criteria, assuming a 60 kg individual respires 20 m^3 of air daily and that the contaminants have equal biological availability via the oral and inhalation routes of exposure. The aquatic toxicity LC_{50} data would usually be derived from 96-hour exposures.

Scoring criteria for this parameter are as follows:

CRITERIA

PARAMETER SCORE	Oral LD_{50} mg/kg	Dermal LD_{50} mg/kg	Inhalation LC_{50} mg/m^3	Aquatic LC_{50} mg/L
10	$\leq$0.5	$\leq$0.5	$\leq$1.5	$\leq$0.1
8	>0.5 - 5	>0.5 - 5	>1.5 - 15	>0.1 - 1
6	>5 - 50	>5 - 50	>15 - 150	>1 - 10
4	>50 - 500	>50 - 500	>150 - 1500	>10 - 100
2	>500 - 5000	>500 - 5000	>1500 - 15000	>100 - 1000
0	>5000	>5000	>15000	>1000

Suggested Information Sources

ACQUIRE database -

This database contains acute lethality values for aquatic and terrestrial species.

Hayes, 1982 -

Contains information on the toxicology of pesticides and associated chemicals with particular reference to effects in humans.

Ketchen and Porter, 1979 -

These Critical Material Data sheets summarize information on the toxic potential of individual chemicals, including acute lethality data, in terrestrial species.

Merck Index -

The Merck Index lists indices of toxicity for many chemicals in terrestrial species.

MEDLINE database -

A computerized database presenting titles and abstracts of published, worldwide, biomedical literature.

Clayton & Clayton, 1981 -

Summarizes the toxic characteristics of a large number of industrial chemicals, primarily in terrestrial species.

(b) SUB-LETHAL EFFECTS ON NON-MAMMALIAN SPECIES

Rationale

This parameter describes potential effects from long-term exposures of non-mammalian species to chemicals. The effects-data may be

expressed as median effect concentration (EC_{50}), maximum aquatic toxic concentration (MATC) or no-observed-adverse-effect-concentration (NOAEC).

The most frequently reported data of these types are EC_{50} values for fish or other aquatic organisms such as daphnia. Associated with an EC_{50} value is the species studied, the endpoint(s) observed, and the duration of exposure. Common endpoints are immobilization, loss of equilibrium, effects on reproduction and other sub-lethal effects. As with other parameters, if different indicators of effects are available, the most sensitive would be used unless scorer judgement indicates otherwise.

As with mammalian toxicity, duration of exposure is important to the interpretation of the results. For aquatic organisms, either full or partial life-cycle tests are preferred for the assessment of reproductive effects. Such tests may last as few as seven days or extend beyond a year, depending on the life cycle. For terrestrial animals, periods of exposure usually last several months. For other types of effects, results from 96-hour exposures generally have more credence than shorter exposures. In addition, preference should be given to tests on freshwater species native or introduced to North America.

Scoring Criteria

Based on published results of the effects of many substances on aquatic organisms, the NOAEC values that appear in the score definitions are a factor of 100 lower than EC_{50} values (Konemann and Visser, 1983). Maximum Aquatic Toxic Concentration (MATC) values are 10 times lower than EC_{50} values.

The scoring criteria for this parameter are as follows:

PARAMETER SCORE	CRITERIA
10	EC_{50} ≤0.02 mg/L; OR MATC ≤0.002 mg/L; OR NOAEC ≤0.0002 mg/L in different genera.
8	EC_{50} ≤0.02 mg/L; OR MATC ≤0.002 mg/L; OR NOAEC ≤0.0002 mg/L in one genus only.
6	EC_{50} <0.2 - 0.02 mg/L; OR MATC <0.02 - 0.002 mg/L; OR NOAEC <0.002 - 0.0002 mg/L.
4	EC_{50} <2 - 0.2 mg/L; OR MATC <0.2 - 0.02 mg/L; OR NOAEC <0.02 - 0.002 mg/L.
2	EC_{50} <20 - 2 mg/L; OR MATC <2 - 0.2 mg/L; OR NOAEC <0.2 - 0.02 mg/L.
0	EC_{50} ≥20 mg/L; OR MATC ≥ 2 mg/L; OR NOAEC ≥0.2 mg/L.

Suggested Information Sources

AQUIRE database -

AQUIRE has EC_{50} and/or NOAEC data for aquatic organisms for some organic chemicals.

Most information required for this element must be sought from primary sources identified through literature searches.

(c) SUB-LETHAL EFFECTS ON PLANTS

Rationale

Sub-lethal effects on plants are highly varied depending on the toxicant. The relative significance of the injury or effect depends on the commodity and its use. These can be divided into three categories.

A The appearance is important, but growth and yield are of much less importance. This is relevant for ornamentals, flower crops, leafy vegetables and fruit.

B The impact on growth and yield are the most significant, and visible injury to the foliage, though unsightly, is of less importance. This is relevant for vegetables, fruits, seeds and storage organs such as tubers.

C There are no visible injurious effects but the longevity of the commodity has been altered. This is of greatest significance in flower crops and storage of fruit and vegetables.

The toxic effects can generally be assayed using short-term tests with indicator plants. The possible effects include a wide spectrum of responses: inhibition of germination, inhibition of seedling growth, growth abnormalities, reduction in either root or shoot growth, etc.

Long-term tests with annual plants may be used to assess chronic effects such as decreased yield or decreased competitiveness (NAS, 1975).

The most commonly tested aquatic plants are algae and duckweed (Lemna minor) (U.S. EPA, 1978). Several test methods have been developed that use algae (for example, the U.S. EPA Algal Assay Bottle Test). Duckweed has been used to assess the effects of substances on aquatic macrophytes, (EPA, 1978).

Effects on the genetic makeup of the organism may be assayed using other short-term tests with plant material. These include gene mutations, DNA repair, primary DNA damage and chromosomal aberrations (Sandhu, 1980). Some examples of genetic mutation assays using plants are the measurement of chromosomal aberrations in root tip cells, the Tradescantia micronucleus assay (Sandhu, 1980) and the use of Arabidopsis for measuring the frequency of mutational events at the embryo stage (Redei, 1980).

Scoring Criteria

The score definitions for aquatic plants are very similar to those used in parameters which address sub-lethal effects on aquatic animals.

Various biomonitors have been used for different contaminants with each species displaying characteristic symptoms for a given pollutant. Some of these tests have been standardized to a substantial degree while others are only qualitative indicators. Standardized sampling methods have also been devised for substances that accumulate in vegetation and that are toxic to animals. Lichens are also used for a variety of contaminants, both as indicators by presence or absence, or are used as accumulators.

Standardized tests have been reported for relatively few substances. In some cases, the scoring system can accommodate results expressed in concentration units (mg/L for substance in water, ug/m^3 for gaseous

contaminants, and mg/kg for substances in the soil), but in most instances, the length of exposure time is very important. It is thus necessary to link the persistence or the number of releases or the length of exposure to this element in some way through the use of appropriate combining rules.

Precautions. Soil extraction procedures are critical in determining the level of a toxicant. E.g., the total amount removed by acid extraction may not be meaningful in relation to plant bioavailability.

PARAMETER SCORE	CRITERIA AQUATIC PLANTS	TERRESTRIAL PLANTS
10	EC_{50} <0.1 mg/L OR NOAEC <0.001 mg/L	NOAEC <0.01 mg/L in water OR <10 ug/m^3 in air OR <0.01 mg/kg in soil
8	EC_{50} 0.1 - 1 mg/L OR NOAEC 0.001 - 0.01 mg/L	NOAEC >0.01 - 0.1 mg/L in water OR >10 - 100 ug/m^3 in air OR >0.01 - 0.1 mg/kg in soil
6	EC_{50} >1 - 10 mg/L OR NOAEC >0.01 - 0.1 mg/L	NOAEC > 0.1 - 1 mg/L in water OR >100 - 500 ug/m^3 in air OR >0.1 - 1 mg/kg in soil
4	EC_{50} >10 - 100 mg/L OR NOAEC >0.1 - 1 mg/L	NOAEC >1 - 10 mg/L in water OR >500 - 1000 ug/m^3 in air OR 1 - 10 mg/kg in soil
2	EC_{50} >100 - 1000 mg/L OR NOAEC >1 - 10 mg/L	NOAEC >10 - 100 mg/L in water OR >1000 ug/m^3 in air OR >10 - 100 mg/kg in soil
0	No effects produced in adequate testing.	No effects produced in adequate testing.

Suggested Information Sources

Manning and Feder, 1980-
Discusses the use of plants as monitors of pollution.

Lepp, 1981 -
Discusses effects of heavy metals in plants.

Martin and Coughtrey, 1982 -
Discusses effects of heavy metals on biota as indicators of pollution.

NACC -
Publications of the Associate Committee on Scientific Criteria for Environmental Chemistry includes data on effects on plants.

Levitt, 1980 -
Reviews environmental stress on plants.

Ormrod, 1978 -
Reviews effects of pollution on horticulture.

Information will have to be sought from primary sources for many of the toxicants.

(d) SUB-LETHAL EFFECTS ON MAMMALS

Rationale

This parameter describes potential longer-term effects of chemicals in mammals. The effects are directed primarily at human health, although the actual data used will largely be from laboratory animals. Other scoring systems (see Hushon and Kornreich, 1984) generally score chemicals for sub-lethal toxicity based on specific effects (e.g., separate scores for carcinogenicity, mutagenicity, teratogenicity, etc.), but most do not address systemic toxic effects. The toxic effects included in this parameter are restricted to sub-lethal systemic effects, but do not include carcinogenic, mutagenic or teratogenic effects since these are included in other parameters.

Scoring Criteria

If data are not available on the effects following a suitable duration of exposure, either appropriate "tags" (!, ? or e) should be used, or, preferably, the criteria should be divided by an appropriate extrapolation factor to adjust for potential effects that would not develop during shorter exposure studies. Criteria used in the development of scores for this parameter would be derived from sub-chronic (generally 90-day exposure) or chronic (usually 1 year or more) exposure studies in any mammalian species (refer to the general discussion of exposure duration). If the data were derived from sub-chronic studies, it is recommended that the NOAEL (No-Advance-Effect-Level) be divided by a 10-fold extrapolation factor (see FDA, 1982; Dourson and Stara, 1983). If the only data available involved even shorter term exposures (e.g., 14 days), it is recommended that a 100-fold extrapolation factor be used. Considerable judgement will be required in the utilization of such extrapolation factors, considering issues such as the biological half-life of the chemical, the biological characteristics of the test system from which the data was derived and knowledge of the usual consequences of the type(s) of lesions produced.

The scoring criteria for this parameter do not provide for differences in the type of toxic response observed. For example, if the effects associated with exposure are irreversible, the consequences of exposure are much more serious than if the effects reverse following cessation of exposure. For the purposes of this assessment, all effects are considered as equal but details of differences in the severity of the effects would be carefully noted.

Examples of the various end-points included as chronic systemic effects are as follows:

Reproduction toxicity - Adverse effects on reproduction as they affect the survival, development and well-being of the species, including interference with gonadal functions but excluding teratogenic effects.

General toxicity

- General depressions in body weight and body weight gains, general behavioural alterations and increases in diseases secondary to chemical exposure.

- Gross or microscopic alterations indicative of disease from toxic events.

- Adverse or deleterious effects on organ systems or functions, alterations in secretions of exocrine and endocrine glands, alterations in the brain and peripheral nervous systems.

- Treatment related biochemical effects.

If data are available on more than one of these effects, the effect occurring at the lowest exposure level in the most sensitive test system should be used in scoring. In addition, structure-activity relationships may provide estimates of the occurrence of chronic effects if data on the actual compound are lacking. Structure-activity relationships appear reasonably predictive for certain types of effects (e.g., narcotic effects). However, little predictive value is obtained for other effects using available methods. In the future, the accuracy of structure-activity relationships in predicting effects between different chemicals may improve. Even with present methodologies, however, an estimation of potential effects may prove more valuable than accepting a judgement of inadequate information. Such estimates, however, would be appropriately "flagged" with a "?" or "e".

The scoring system for this parameter is as follows:

PARAMETER SCORE	CRITERIA[1] ORAL NOAEL mg/kg	INHALATION NOAEL mg/m^3
10	$\leq$0.1	$\leq$0.3
8	>0.1 - 1	>0.3 - 3
6	>1 - 10	>3 - 30
4	>10 - 100	>30 - 300
2	>100 - 1000	>300 - 3000
0	>1000	>3000

[1] Criteria are based on data from exposures of 1 year or more in duration. If data from studies of 28 to 90-days exposure are used, divide all scoring criteria by 10. If data from 14-day studies are used, divide all scoring criteria by 100.

Suggested Information Sources

Most of the information on the toxic effects associated with chronic exposure to chemicals would be obtained from original scientific publications which could be accessed through the MEDLINE and TOXLINE databases. Additional sources of summary data include Ketchen and Porter (1979), Clayton and Clayton (1981), RTECS database, and Verschueren (1983). It should be emphasized however, that the judgement of the validity of a NOEL (No-Effect-Level) from summary data is difficult and that original publications should be consulted.

(e) TERATOGENICITY

Rationale

This parameter describes the potential teratogenic effects of chemicals on mammalian systems. Toxic effects on reproduction in plants, non-mammalian and mammalian systems, as distinct from developmental defects, are described in parameters b, c, and d. The production of terata by exposure to chemical contaminants can seriously compromise the development and survival of offspring. Such effects are usually irreversible, although current understanding is that they have an exposure threshold (EPA, 1984).

The criteria for these effects are as outlined by the U.S. Environmental Protection Agency (EPA, 1984). Teratogenic effects include frank developmental malformations detrimental to the survival, future development, or well-being of newborn. They do not include developmental anomalies and aberrations that appear to be secondary to embryo-, feto- and maternal toxicity (see EPA, 1984; Khera, 1981). Many such effects are known to recover as development proceeds (e.g., reversible delayed ossification of various parts of the skeleton, delayed development of specific organs, delayed eye opening, delayed vaginal opening, reduced body weight) (Khera, 1981). In some cases, exposure of pregnant females to chemicals can result in malnutrition due to decreased feed intake. Malnutrition has been shown to delay embryo and fetal development, reduce birth weights and, in severe cases, produce irreversible neurological and metabolic abnormalities (EPA, 1984; Khera, 1984). These differences in the apparent severity between frank terata and minor developmental anomalies from chemicals are reflected in the scoring criteria for this element.

Behavioural teratology is a rapidly developing sub-field of teratology and includes effects related to alterations in the behaviour of the offspring as they mature. In some cases behavioural effects may not be evident until maturity (e.g., effects on sexual behaviour). Other effects may only be temporary and actually disappear at some later

stage of development. No specific criteria have been included in this parameter for behavioural teratogenic effects and judgement must be exercised to determine how such effects "fit" into the criteria provided. As the significance of such effects is better understood, alterations in the criteria for this parameter may be required to encompass the increase in knowledge.

Scoring Criteria

Working from the assumption that teratogenic effects exhibit exposure thresholds (Khera, 1981; EPA, 1984), scoring criteria are based on gradations in exposure levels associated with effects. Since teratogenic effects are viewed as more serious than developmental anomalies as outlined above, higher scores are applied to chemicals showing evidence of frank teratogenicity. Chemicals producing developmental anomalies and aberrations are assigned lower scores (e.g., delayed ossificaton of bone, decrease fetal weights, decreased birth weights, prolonged gestation, decreased survival without abnormalities, developmental effects that reverse during postnatal development.

Duration of exposure is particularly critical in assessing teratogenic effects. To adequately assess the potential for such effects from a chemical exposure, the exposure should occur at least through the period of organogenesis (e.g., usually from late in the first trimester through early in the third trimester of gestation). In addition, the levels of exposure studied should be sufficient to elicit a range of effects in the dams, from toxicity at the higher exposures to no-observable effects at the lower exposures (Grice et al. 1975; EPA, 1984; Khera, 1981).

The general requirements regarding route of exposure discussed earlier also apply to teratogenicity assessments.

The scoring criteria for this parameter are as follows:

PARAMETER SCORE	CRITERIA
10	- Teratogenic effects observed without overt maternal toxicity at maternal exposures ≤0.1 mg/kg/day during organogenesis, or equivalent exposure[1]
8	- Teratogenic effects observed without maternal toxicity at maternal exposures >0.1 - 1 mg/kg/day during organogenesis or equivalent exposure
6	- Teratogenic effects or developmental anomalies observed at maternal exposures >1 - 10 mg/kg/day during organogenesis or equivalent exposure
4	- Teratogenic effects or developmental anomalies observed at maternal exposures >10 - 50 mg/kg/day during organogenesis or equivalent exposure
2	- Teratogenic effects or developmental anomalies obsreved at maternal exposures >50 - 1000 mg/kg/day during organogenesis or equivalent exposure
0	- No terata or effects on reproduction observed at exposures ≥1000 mg/kg/day or equivalent exposure

[1] Equivalent exposure by inhalation or dermal routes, assuming effects by dermal exposure would occur at comparable doses to oral exposure and that the total dose by inhalation is equivalent to oral exposure based on a 60 kg adult respiring 20 m^3 of air daily. These assumptions mean that the dermal and oral exposure levels are equivalent, and inhalation exposures (in mg/m^3) are obtained by multiplying the oral exposure by three.

Information Sources

Most of the information on the teratogenic effects associated with exposure to chemicals can be obtained from original scientific publications which can be accessed through the MEDLINE and TOXLINE databases. Additional sources of summary data include Ketchen and Porter (1979), Clayton and Clayton (1981), RTECS database, and Verschueren (1983). Care should be exercised in using the RTECS data base since only studies showing positive effects associated with exposure are reported. It must also be emphasized that the judgement of the validity of teratogenic effects (e.g., the evaluation of frank developmental anomalies versus developmental aberrations) from summary data is difficult and that original publications should be consulted.

(f) GENOTOXICITY/MUTAGENICITY

Rationale

This parameter describes the mutagenic and genotoxic potential of a chemical. Such effects in themselves are indicative of potential hazards of chemicals to health and the environment. In addition, the strength of such evidence is valuable in the interpretation of other potential hazards from chemicals (e.g., carcinogenicity).

Genotoxic or mutagenic effects on somatic or germ cells are considered equal potential hazards. Evidence of heritable mutations (i.e., mutations in germ cells) was regarded as more indicative of the test system studied and ability of a chemical to distribute to germ cells (i.e., the disposition of the chemical in vivo) rather than of a greater potential hazard. In addition, assessment of the potential for germ cell mutations requires specific tests (e.g., dominant lethal test, mouse heritable translocation assay) and results from such tests are not available for large numbers of chemicals. Therefore, specific scoring criteria for germ cell mutations would increase the dependency of the resulting prioritization of chemicals on the information

available rather than indicators of potential hazard. In the scoring criteria used, chemicals for which evidence of germ cell mutations are available would receive high scores, but not preferentially higher than chemicals with evidence of somatic mutations only.

Scoring Criteria

The criteria assign higher scores to chemicals with adequate evidence of mutagenic/genotoxic effects derived from short-term tests. The primary objective is to score the potential of a chemical to produce such effects.

Chemicals producing direct mutagenic/genotoxic effects in the absence of overt toxicity are assigned the highest scores (e.g., the chemical or its activated metabolite(s) directly acts on genetic material to produce mutations or genotoxic effects). Clastogenic effects produced by chemicals that do not directly interact with genetic material are scored in the next category. Chemicals causing mutagenic or genotoxic effects indirectly by interfering with various cellular systems would receive lower scores. Scores of two or four should be assigned to chemicals having positive evidence from certain test systems but clear evidence of lack of effects in other test systems.

It is assumed that all test data will be derived under optimal experimental conditions (e.g., using validated test procedures, including appropriate S-9 metabolic activating systems, adequately controlling for unusual chemical/physical characteristics of the test chemicals). Acceptable tests include, but are not necessarily limited to, the following:

a) *in vitro* gene mutation

- *Salmonella*/mammalian microsome assay
- CHO/HGPRT - assay
- L5178Y TK - assay
- Haploid *Saccharomyces* assay

b) *in vitro* mammalian chromosomal aberrations

- metaphase analysis in mammalian cells exposed *in vitro* (not including sister chromatid exchange and micronuclei)

c) *in vivo* mammalian chromosomal aberrations

- rodent bone marrow micronucleus assay
- rodent bone marrow metaphase analysis (not including sister chromatid exchange)

d) *in vivo* mammalian gene mutation or indicator tests in a second somatic tissue

- rodent liver unscheduled DNA synthesis
- rodent sister chromatid exchange

Data from other tests may be used with appropriate justification. There will be many chemicals for which adequate information for this parameter is lacking or incomplete. The use of structure- activity relationships in developing scores for this parameter may be a viable alternative in the future. However, at present such concepts are only in their formative stages (FDA, 1982; NTP, 1984; OSTP, 1985). Consequently, considerable expertise and judgement are required to assign scores based on structure-activity information and such scores would require appropriate "flags" to signify the level of confidence in the data used (e.g., !, ?, e).

The scoring criteria for this parameter are as follows:

PARAMETER SCORE	CRITERIA
10	Conclusive evidence of mutagenicity or genotoxicity in recognized prokaryotic or eukaryotic test systems at exposure levels not producing overt toxic effects
8	Evidence of clastogenic effects (general DNA damage, strand breaks, sister chromatid exchange), intercalations or crosslinks but no evidence of increased incidences of mutations or direct interactions with genetic material
6	Does not interact directly with DNA, but interferes with cellular mechanisms such as DNA synthesis and DNA repair. Effects may be observed at exposure levels associated with overt toxicity unrelated to genetic effects
4	Mutagen/genotoxin in prokaryotic systems only (i.e., data from eukaryotic test systems are negative).
2	Mutagen/genotoxin in in vitro systems only (i.e., data from in vivo systems are negative).
0	No evidence of mutagenic or genotoxic effects in a adequate battery of test systems.

Suggested Information Sources

Information on the genotoxicity/mutagenicity of chemicals would generally be obtained from original publications and review articles

as identified through MEDLINE or TOXLINE databases or through the GenTox Information Service. Information may also be available from various summary data sources including Bowman (1982), Fairchild (1978), Fishbein (1979), Ketchen and Porter (1979), Kirsch-Volders (1983), Sax et al. (1981), Soderman (1983), Sontag (1981), and Stich and San (1984). It is difficult to judge the validity of genotoxicity/ mutagenicity tests from summary data. Original publications should be consulted where possible.

(g) CARCINOGENICITY

Rationale

This parameter describes the potential of chemicals to cause cancer. Detailed assessment of the dose-response relationships, types of cancers produced, the validity of extrapolating carcinogenicity data among species and the processes of risk identification, assessment and management are beyond the sophistication of this assessment.

There is general agreement that radiation, biological, physical and chemical agents can cause cancer. In addition, the biochemical and molecular process of cancer development, as it is understood, is similar among mammalian species (NTP, 1984; OSTP, 1985). It is evident that the development of cancer is a multi-stage process involving interactions of agents with genetic material (the genome). The induction of tumorigenic phenotypes through interactions with the genome may occur directly through the induction of somatic mutations or indirectly by alterations in gene expression. A number of factors affect the occurrence of these events, including age, sex, genetic differences, strain and species differences, diet, dose rate, route of exposure, interactions with other agents and a variety of environmental conditions (NTP, 1984; OSTP, 1985). Furthermore, the production of these effects by a chemical may be by direct action of the chemical or its metabolites (e.g., direct acting, genotoxic carcinogens) or indirect through actions of the chemical on systems that secondarily

produce tumorigenic phenotypes (e.g., non-genotoxic or epigenetic mechanism). Although the detailed mechanism(s) of cancer production is not fully understood, it is evident that once the required modification in the genome occurs (known as initiation), the process is irreversible and self-propagating. A wide range of factors affect the initiation process, however, and many of these are believed to be reversible (IRLG, 1979; NTP, 1984; OSTP, 1985).

Although the exact mechanisms of the various stages of carcinogenesis are not fully understood, it is apparent that the events leading to the initiation of cells are dose-related (i.e., the frequency of occurrence of initiation increases with exposure). Once initiation has occurred, however, the subsequent development of tumours is independent of the exposure level (IRLG, 1979). This information is important to the scoring of the carcinogenic potential of a chemical.

Based on this brief summary of what is known about the process of carcinogenesis (refer to IRLG, 1979, NTP, 1984 and OSTP, 1985, for more detailed discussions), the scoring criteria for this element differentiate between direct acting and indirect acting carcinogens. It is important that the scoring system not merely reflect the completeness of the data base (e.g., only a few chemicals have been adequately studied from an epidemiological point of view in human populations to assess their carcinogenicity). For many chemicals, epidemiological studies to assess their carcinogenic potential will never be conducted and complete reliance will have to be placed on animal bioassay data for their evaluation. If the data from animal bioassays are viewed sufficiently strong, "epidemiologically proven" and "potential human" carcinogens (i.e, positive in animal bioassays) are given equal weight in the scoring system.

Scoring Criteria

The following definitions of carcinogenicity are used in scoring this parameter (Tomatis, 1979):

- Evidence of carcinogenicity is positive when an increase in malignant tumours is caused in more than one species or strain, in multiple experiments with varying routes or levels of exposure or to an unusual degree with respect to type, site, incidence or latency period.

- Evidence of carcinogenicity is negative when no tumour induction is observed in at least two adequate and appropriate animal studies in different species, or in both animal and epidemiology studies.

- Evidence of carcinogenicity is inconclusive when neither of the above two conditions apply, usually because the observations are inadequate, of unacceptable quality or excessively limited. Contradictory results from different test systems may also lead to an inconclusive assessment. Such conditions are recorded as either positive or negative for carcinogenicity and tagged with either a ? or ! depending on the interpretation of the information by the scorer.

There is a great deal of controversy regarding the potency ranking of carcinogens, particularly when attempting to denote the potency of a chemical to cause cancer in man from data derived from animal cancer bioassays. Animal bioassays utilize high exposure levels (known as the Maximum Tolerated Dose or MTD protocol, see NTP, 1984; OSTP, 1985). Judgements of carcinogenic potency based on information derived from such high levels of exposure may have little relationship to potencies at lower levels of exposure comparable to those found in the environment. Consequently, the basis for potency ranking is not considered adequately developed for use in a scoring system. However, if procedures for such ranking were found reliable, they would form a reasonable basis for the scoring of the carcinogenic potential of chemicals.

Important information to assist in the interpretation of animal cancer bioassay data vis-a-vis the potential of a chemical to cause cancer in humans can be derived from assessments of its mutagenicity/ genotoxicity.

The scoring scheme for this parameter is as follows:

PARAMETER SCORE	CRITERIA
10	Direct acting human carcinogen or potential human carcinogen (based on animal bioassay data) with evidence of direct interactions with genetic material. Acts as an electrophile or direct alkylating agent, produces DNA adducts, induces cell transformation, etc.
8	Indirect acting human carcinogen or potential human carcinogen (based on animal bioassay data) with evidence that it does not interact with genetic material
6	Carcinogenic in animal bioassay tests at levels of exposure shown to saturate enzymes involved in the metabolism of the compound, or at exposure levels shown to cause histopathological lesions known to predispose animals to the development of cancers at sites where the lesions are observed (e.g., ATPAse deficient liver foci in rodents). Adequate evidence must be available demonstrating that no interactions occur with genetic material and that the chemical does not induce cell transformation
4	Positive tumorigenic agent (benign tumours) in humans or animals. Evidence must be available of lack of interactions with genetic material. Includes chemicals that act solely as promoters and those that cause cell transformation in vitro without evidence in other systems
2	Tumorigenic in only one animal species and negative in other(s) (all studies considered adaquate)
0	Not tumorigenic in an adequate animal bioassay in at least two species and must not interact with genetic material

Information Sources

Information on the carcinogenicity of chemicals would generally be obtained from original publications and review articles as identified through IARC Monographs or MEDLINE, TOXLINE databases or National Toxicology Program (NTP) publications. Information may also be available from various summary data sources including Bowman (1982), Fairchild (1978), Fishbein (1979), Ketchen and Porter (1979), Kirsch-Volders (1983), Sax et al (1981), Soderman (1983), Sontag (1981), and Stich and San (1984). However, it is difficult to judge the validity of carcinogenicity data from summary data and original publications should be consulted.

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APPENDIX B

APPLICATIONS OF THE DE MINIMIS CONCEPT

Scenarios Where "de minimis" Considerations May Apply

1. Concentration of contaminant in the stack is less than the ambient air standard.

2. Concentration of contaminant in the stack is less than some reasonable factor times the ambient air standard.

Possible Factors for Determining Emission Level Criteria

For the second scenario, permitting the actual stack concentration to be a factor of 100 times the air quality standard (24-hour average value) to allow for dispersion is not unreasonable, as a factor of dilution in air of 1,000 to 10,000 is commonly achieved even over shorter periods (i.e., 30 minutes). In special cases where this dilution factor of 100 would not be sufficient to protect the public or the environment, the modelling would so indicate and override the "de minimis" criteria.

It should be noted again that these criteria apply to undiluted emissions only; a "de minimis" exemption would not be permitted where combined emissions from different types of sources exit through a common stack. However, several identical sources leading to a common stack would be considered.

Example 1

A source emits zinc dust at a concentration of 50 micrograms per standard cubic metre in the exhaust. The air quality criterion (24 hour average) for zinc is 100 micrograms per standard cubic metre.

This source meets the requirements for a "de minimis" exemption under scenario 1; the contaminant meets the air quality standard in the stack.

Example 2

A source emits chlorine gas at a concentration of 950 micrograms per standard cubic metre in the exhaust. The air quality criterion (24 hour average) for chlorine gas is 150 micrograms per standard cubic metre.

This source would be eligible for a "de minimis" exemption from control requirements under scenario 2; the stack concentration is less than 150,000 micrograms per standard cubic metre (100 times the air quality criterion of 150 micrograms per standard cubic metre).

Example 3

A source emits acetone vapour at a concentration of 5,000,000 micrograms per standard cubic metre in an exhaust stream. The air quality criterion (24 hour average) for acetone is 48,000 micrograms per standard cubic metre.

This source does not meet the requirements for a "de minimis" exemption. The concentration of acetone in the exhaust exceeds 4,800,000 micrograms per standard cubic metre (100 times the air quality criterion of 48,000 micrograms per standard cubic metre).

Example 4

A source emits sulphur dioxide at a concentration of 300 milligrams per standard cubic metre, inorganic arsenic compounds at a concentration of 0.1 micrograms per standard cubic metre, and suspended particulate matter at a concentration of 100 milligrams per standard cubic metre, in a single exhaust stream. The air quality criterion (24 hour average) for sulphur dioxide is 275 micrograms per standard cubic metre; for arsenic it is 0.3 micrograms per standard cubic metre; and for suspended particulate matter it is 120 micrograms per standard cubic metre.

It is necessary to look at all contaminants before a final decision on the need for control is made. For sulphur dioxide, the exhaust concentration is greater than the maximum acceptable level of 27.5 milligrams per standard cubic metre (100 times 275 micrograms per standard cubic metre). For arsenic, the exhaust concentration is much less than the maximum accepted for a "de minimis" exemption - in this case, 30 micrograms per standard cubic metre (100 times 0.3 micrograms per standard cubic metre). For suspended particulate matter, the exhaust concentration is again quite high as compared to the criterion value of 12 milligrams per standard cubic metre (100 times 120 micrograms per standard cubic metre).

This source will require appropriate control technology to reduce emissions of sulphur dioxide and suspended particulate matter, but arsenic emissions may be considered negligible and require no specific action. It may be noted that control of the suspended particulate matter may well reduce emissions of arsenic as well.

APPENDIX C

METHOD FOR CALCULATING STANDARDS FOR DIFFERING AVERAGING TIMES

If one has a standard set at a concentration C_o, based on an averaging time of T_o minutes (as considered reasonable due to the effect of the contaminant of concern), then an equivalent concentration of C_1, based on an averaging time of T_1 minutes (such as that imposed by the sampling methodology), can be established using the following formula:

$$C_1 = C_o \times [T_1 / T_o]^{-0.28047}$$

APPENDIX D

ENVIRONMENTAL PROTECTION AGENCY REGULATIONS ON STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES - METHOD 9

(Extracted from Environmental Reporter, published by The Bureau of National Affairs, Inc., 1231 25th Street, N.W., Washington, D.C. 20037, U.S.A.)

METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified obeervers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

[1] For a set, positive error=average opacity determined by observers' 25 observations—average opacity determined from transmissometer's 25 recordings.

1. *Principle and applicability.*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedures.* The observer qualified in accordance with paragraph 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g. roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g. stub stacks on baghouses).

2.2 Field records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, and the date on a field data sheet (Figure 9–1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observation shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached steam plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached steam plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9-2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9-1 for an example.)

3. *Qualifications and testing.*

3.1 Certification requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in paragraph 3.2. Smoke generators used pursuant to paragraph 3.2 shall be equipped with a smoke meter which meets the requirements of paragraph 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke generator specifications. Any smoke generator used for the purposes of paragraph 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9-1. The smoke meter shall be calibrated as prescribed in paragraph 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9-1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9-1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter:	*Specification*
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—reference 4.3).
c. Angle of view	15° maximum total angle.
d. Angle of projection.	15° maximum total angle.
e. Calibration error.	±3% opacity, maximum.
f. Zero and span drift.	±1% opacity, 30 minutes.
g. Response time	≤5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke meter evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral response of photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

3.3.2.3 Angle of view. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $\theta = 2 \tan^{-1} d/2L$, where θ = total angle of view; d = the sum of the photocell diameter + the diameter of the limiting aperture; and L = the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta = 2 \tan^{-1} d/2L$, where θ = total angle of projection; d = the sum of the length of the lamp filament + the diameter of the limiting aperture; and L = the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibarted within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and span drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response time. Determine the response time by producng the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *References.*

4.1 Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

4.2 Weisburd, Melvin I., Field Operations and Enforcement Manual for Air, U.S. Environmental Protection Agency, Research Triangle Park, N.C., APTD-1100, August 1972, pp. 4.1-4.36..

4.3 Condon, E. U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., N.Y., N.Y., 1958, Table 3.1, p. 6-52.

[Appendix A, Method 9]

FIGURE 9-1
RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE___of___

COMPANY_____
LOCATION_____
TEST NUMBER_____
DATE_____
TYPE FACILITY_____
CONTROL DEVICE_____

HOURS OF OBSERVATION_____
OBSERVER_____
OBSERVER CERTIFICATION DATE_____
OBSERVER AFFILIATION_____
POINT OF EMISSIONS_____
HEIGHT OF DISCHARGE POINT_____

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ___ to ___ % opacity

The source was/was not in compliance with ___ at the time evaluation was made.

FIGURE 9-2 OBSERVATION RECORD PAGE ___ OF ___

COMPANY _____ OBSERVER _____
LOCATION _____ TYPE FACILITY _____
TEST NUMBER _____ POINT OF EMISSIONS _____
DATE _____

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

FIGURE 9-2 OBSERVATION RECORD (Continued) PAGE ___ OF ___

COMPANY _____ OBSERVER _____
LOCATION _____ TYPE FACILITY _____
TEST NUMBER _____ POINT OF EMISSIONS _____
DATE _____

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	30							
	31							
	32							
	33							
	34							
	35							
	36							
	37							
	38							
	39							
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Published by THE BUREAU OF NATIONAL AFFAIRS INC WASHINGTON D C 20037

[Appendix A, Method 9]

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Alternate Method 1—Determination of the Opacity of Emissions From Stationary Sources Remotely by Lidar

[Method 9, Alternate Method 1 added by 46 FR 53148, October 28, 1981]

This alternate method provides the quantitative determination of the opacity of an emissions plume remotely by a mobile lidar system (laser radar; Light Detection and Ranging). The method includes procedures for the calibration of the lidar and procedures to be used in the field for the lidar determination of plume opacity. The lidar is used to measure plume opacity during either day or nighttime hours because it contains its own pulsed light source or transmitter. The operation of the lidar is not dependent upon ambient lighting conditions (light, dark, sunny or cloudy).

The lidar mechanism or technique is applicable to measuring plume opacity at numerous wavelengths of laser radiation. However, the performance evaluation and calibration test results given in support of this method apply only to a lidar that employs a ruby (red light) laser [Reference 5.1].

1. Principle and Applicability

1.1 Principle. The opacity of visible emissions from stationary sources (stacks, roof vents, etc.) is measured remotely by a mobile lidar (laser radar).

1.2 Applicability. This method is applicable for the remote measurement of the opacity of visible emissions from stationary sources during both nighttime and daylight conditions, pursuant to 40 CFR § 60.11(b). It is also applicable for the calibration and performance verification of the mobile lidar for the measurement of the opacity of emissions. A performance/design specification for a basic lidar system is also incorporated into this method.

1.3 Definitions.

Azimuth angle: The angle in the horizontal plane that designates where the laser beam is pointed. It is measured from an arbitrary fixed reference line in that plane.

[1.3 corrected by 47 FR 28624, July 1, 1982]

Backscatter: The scattering of laser light in a direction opposite to that of the incident laser beam due to reflection from particulates along the beam's atmospheric path which may include a smoke plume.

Backscatter signal: The general term for the lidar return signal which results from laser light being backscattered by atmospheric and smoke plume particulates.

Convergence distance: The distance from the lidar to the point of overlap of the lidar receiver's field-of-view and the laser beam.

Elevation angle: The angle of inclination of the laser beam referenced to the horizontal plane.

Far region: The region of the atmosphere's path along the lidar line-of-sight beyond or behind the plume being measured.

Lidar: Acronym for Light Detection and Ranging.

Lidar range: The range or distance from the lidar to a point of interest along the lidar line-of-sight.

Near region: The region of the atmospheric path along the lidar line-of-sight between the lidar's convergence distance and the plume being measured.

Opacity: One minus the optical transmittance of a smoke plume, screen target, etc.

Pick interval: The time or range intervals in the lidar backscatter signal whose minimum average amplitude is used to calculate opacity. Two pick intervals are required, one in the near region and one in the far region.

Plume: The plume being measured by lidar.

Plume signal: The backscatter signal resulting from the laser light pulse passing through a plume.

$1/R^2$ correction: The correction made for the systematic decrease in lidar backscatter signal amplitude with range.

Reference signal: The backscatter signal resulting from the laser light pulse passing through ambient air.

Sample interval: The time period between successive samples for a digital signal or between successive measurements for an analog signal.

Signal spike: An abrupt, momentary increase and decrease in signal amplitude.

Source: The source being tested by lidar.

Time reference: The time (t_o) when the laser pulse emerges from the laser, used as the reference in all lidar time or range measurements.

2. Procedures.

The mobile lidar calibrated in accordance with Paragraph 3 of this method shall use the following procedures for remotely measuring the opacity of stationary source emissions:

2.1 Lidar Position. The lidar shall be positioned at a distance from the plume sufficient to provide an unobstructed view of the source emissions. The plume must be at a range of at least 50 meters or three consecutive pick intervals (whichever is greater) from the lidar's transmitter/receiver convergence distance along the line-of-sight. The maximum effective opacity measurement distance of the lidar is a function of local atmospheric conditions, laser beam diameter, and plume diameter. The test position of the lidar shall be selected so that the diameter of the laser beam at the measurement point within the plume shall be no larger than three-fourths the plume diameter. The beam diameter is calculated by Equation (AM1–1):

[2.1 corrected by 47 FR 28624, July 1, 1982]

$$D(\text{lidar}) = A + R\phi \leq 0.75\ D(\text{Plume}) \quad \text{(AM1–1)}$$

where:

D(Plume) = diameter of the plume (cm),

ϕ = laser beam divergence measured in radians

R = range from the lidar to the source (cm)

D(Lidar) = diameter of the laser beam at range R (cm).

A = diameter of the laser beam or pulse where it leaves the laser.

The lidar range, R, is obtained by aiming and firing the laser at the emissions source structure immediately below the outlet. The range value is then determined from the backscatter signal which consists of a signal spike (return from source structure) and the atmospheric backscatter signal [Reference 5.1]. This backscatter signal should be recorded.

When there is more than one source of emissions in the immediate vicinity of the plume, the lidar shall be positioned so that the laser beam passes through only a single plume, free from any interference of the other plumes for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the from the backscatter signals). The lidar shall initially be positioned so that its line-of-sight is approximately perpendicular to the plume.

When measuring the opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks, etc.), the lidar shall be placed in a position so that its line-of-sight is approximately perpendicular to the longer (major) axis of the outlet.

2.2 Lidar Operational Restrictions. The lidar receiver shall not be aimed within an angle of ± 15° (cone angle) of the sun.

This method shall not be used to make opacity measurements if thunderstorms, snowstorms, hail storms, high wind, high-ambient dust levels, fog or other atmospheric conditions cause the reference signals to consistently exceed the limits specified in Section 2.3.

2.3 Reference Signal Requirements. Once placed in its proper position for opacity measurement, the laser is aimed and fired with the line-of-sight near the outlet height and rotated horizontally to a position clear of the source structure and the associated plume. The backscatter signal obtained from this position is called the ambient-air or reference signal. The lidar operator shall inspect this signal [Section V of Reference 5.1] to: (1) determine if the lidar line-of-sight is free from interference from other plumes and from physical obstructions such as cables, power lines, etc., for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, and (2) obtain a qualitative measure of the homogeneity of the ambient air by noting any signal spikes.

[2.3 corrected by 47 FR 28624, July 1, 1982]

Should there be any signal spikes on the reference signal within a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, the laser shall be fired three more times and the operator shall inspect the reference signals on the display. If the spike(s) remains, the azimuth angle shall be changed and the above procedures conducted again. If the spike(s) disappears in all three reference signals, the lidar line-of-sight is acceptable if there is shot-to-shot consistency and there is no interference from other plumes.

Shot-to-shot consistency of a series of reference signals over a period of twenty seconds is verified in either of two ways. (1) The lidar operator shall observe the reference signal amplitudes. For shot-to-shot consistency the ratio of R_f to R_n [amplitudes of the near and far region pick intervals (Section 2.6.1)] shall vary by not more than ± 6% between shots; or (2) the lidar operator shall accept any one of the reference signals and treat the other two as plume signals; then the opacity for each of the subsequent reference signals is calculated (Equation AM1–2). For shot-to-shot consistency, the opacity values shall be within ± 3% of 0% opacity and the associated S_o values less than or equal to 8% (full scale) [Section 2.6].

If a set of reference signals fails to meet the requirements of this section, the last all plume signals [Section 2.4] from the last set of acceptable reference signals to the failed set shall be discarded.

2.3.1 Initial and Final Reference Signals. Three reference signals shall be obtained within a 90-second time period prior to any data run. A final set of three reference signals

shall be obtained within three (3) minutes after the completion of the same data run.

2.3.2 Temporal Criterion for Additional Reference Signals. An additional set of reference signals shall be obtained during a data run if there is a change in wind direction or plume drift of 30° or more from the direction that was prevalent when the last set of reference signals was obtained. An additional set of reference signals shall also be obtained if there is an increase in value of S_{In} (near region standard deviation, Equation AM1-5) or S_{If} (far region standard deviation, Equation AM1-6) that is greater than 6% (full scale) over the respective values calculated from the immediately previous plume signal, and this increase in value remains for 30 seconds or longer.

2.4 Plume Signal Requirements. Once properly aimed, the lidar is placed in operation with the nominal pulse or firing rate of six pulses/minute (1 pulse/10 seconds). The lidar operator shall observe the plume backscatter signals to determine the need for additional reference signals as required by Section 2.3.2. The plume signals are recorded from lidar start to stop and are called a data run. The length of a data run is determined by operator discretion. Short-term stops of the lidar to record additional reference signals do not constitute the end of a data run if plume signals are resumed within 90 seconds after the reference signals have been recorded, and the total stop or interrupt time does not exceed 3 minutes.

2.4.1 Non-hydrated Plumes. The laser shall be aimed at the region of the plume which displays the greatest opacity. The lidar operator must visually verify that the laser is aimed clearly above the source exit structure.

2.4.2 Hydrated Plumes. The lidar will be used to measure the opacity of hydrated or so-called steam plumes. As listed in the reference method, there are two types, i.e., attached and detached steam plumes.

2.4.2.1 Attached Steam Plumes. When condensed water vapor is present within a plume, lidar opacity measurements shall be made at a point within the residual plume where the condensed water vapor is no longer visible. The laser shall be aimed into the most dense region (region of highest opacity) of the residual plume.

During daylight hours the lidar operator locates the most dense portion of the residual plume visually. During nighttime hours a high-intensity spotlight, night vision scope, or low light level TV, etc., can be used as an aid to locate the residual plume. If visual determination is ineffective, the lidar may be used to locate the most dense region of the residual plume by repeatedly measuring opacity, along the longitudinal axis or center of the plume from the emissions outlet to a point just beyond the steam plume. The lidar operator should also observe color differences and plume reflectivity to ensure that the lidar is aimed completely within the residual plume. If the operator does not obtain a clear indication of the location of the residual plume, this method shall not be used.

Once the region of highest opacity of the residual plume has been located, aiming adjustments shall be made to the laser line-of-sight to correct for the following: movement to the region of highest opacity out of the lidar line-of-sight (away from the laser beam) for more than 15 seconds, expansion of the steam plume (air temperature lowers and/or relative humidity increases) so that it just begins to encroach on the field-of-view of the lidar's optical telescope receiver, or a decrease in the size of the steam plume (air temperature higher and/or relative humidity decreases) so that regions within the residual plume whose opacity is higher than the one being monitored, are present.

2.4.2.2 Detached Steam Plumes. When the water vapor in a hydrated plume condenses and becomes visible at a finite distance from the stack or source emissions outlet, the opacity of the emissions shall be measured in the region of the plume clearly above the emissions outlet and below condensation of the water vapor.

During daylight hours the lidar operators can visually determine if the steam plume is detached from the stack outlet. During nighttime hours a high-intensity spotlight, night vision scope, low light level TV, etc., can be used as an aid in determining if the steam plume is detached. If visual determination is ineffective, the lidar may be used to determine if the steam plume is detached by repeatedly measuring plume opacity from the outlet to the steam plume along the plume's longitudinal axis of center line. The lidar operator should also observe color differences and plume reflectivity to detect a detached plume. If the operator does not obtain a clear indication of the location of the detached plume, this method shall not be used to make opacity measurements between the outlet and the detached plume.

Once the determination of a detached steam plume has been confirmed, the laser shall be aimed into the region of highest opacity in the plume between the outlet and the formation of the steam plume. Aiming adjustments shall be made to the lidar's line-of-sight within the plume to correct for changes in the location of the most dense region of the plume due to changes in wind direction and speed or if the detached steam plume moves closer to the source outlet encroaching on the most dense region of the plume. If the detached steam plume should move too close to the source outlet for the lidar to make interference-free opacity measurements, this method shall not be used.

2.5 Field Records. In addition to the recording recommendations listed in other sections of this method the following records should be maintained. Each plume measured should be uniquely identified. The name of the facility, type of facility, emission source type, geographic location of the lidar with respect to the plume, and plume characteristics should be recorded. The date of the test, the time period that a source was monitored, the time (to the nearest second) of each opacity measurement, and the sample interval should also be recorded. The wind speed, wind direction, air temperature, relative humidity, visibility (measured at the lidar's position), and cloud cover should be recorded at the beginning and end of each time period for a given source. A small sketch depicting the location of the laser beam within the plume should be recorded.

If a detached or attached steam plume is present at the emissions source, this fact should be recorded. Figures AM1-I and AM1-II are examples of logbook forms that may be used to record this type of data. Magnetic tape or paper tape may also be used to record data.

LIDAR LOG CONTROL NUMBER TABULATION

Log Book Number-________

[Assign a CONTROL NUMBER to each individual source under test]

CONTROL NUMBER	DATE ASSIGNED	PROJECT	CITY, STATE

continued on next page

LIDAR LOG CONTROL NUMBER TABULATION (cont')

[Assign a CONTROL NUMBER to each individual source under test]

CONTROL NUMBER	DATE ASSIGNED	PROJECT	CITY, STATE

Next Log Book Number-________

Figure AM1-I Lidar Log Control Number Tabulation

LIDAR LOG OF OPERATIONS

Control number OMEGA ______

Facility name and location

At the field site on / / from ______ , to ______ (local time)
Location of LIDAR

Direction to source ______ Range to source ______ km
Laser inclination (+ angle is up horizontal is 0) ______
Source type and official designation

Plume characteristics (color shape steam present, etc.)

Wind speed begin ______ km hr end ______ km hr Wind direction begin ______ end ______
Air temperature begin ______ C end ______ C Relative humidity begin ______ % end ______ %
Barometer begin ______ end ______ Visibility begin ______ km end ______ km
Cloud cover begin ______ end ______

Data records made in field (tapes printouts photos etc.)

MAGNETIC TAPES

tape # track # files

OPERATOR'S SIGNATURE ______ DATE ______

WITNESS SIGNATURE ______ DATE ______

LIDAR OPERATOR'S NOTES

(Include position of laser beam within plume-- attached plume etc.)

LIDAR FUNCTION VERIFICATION Source optical generator ( ) screens ( )

Date of last calibration ______ This test recorded on tape # ______ track # ______

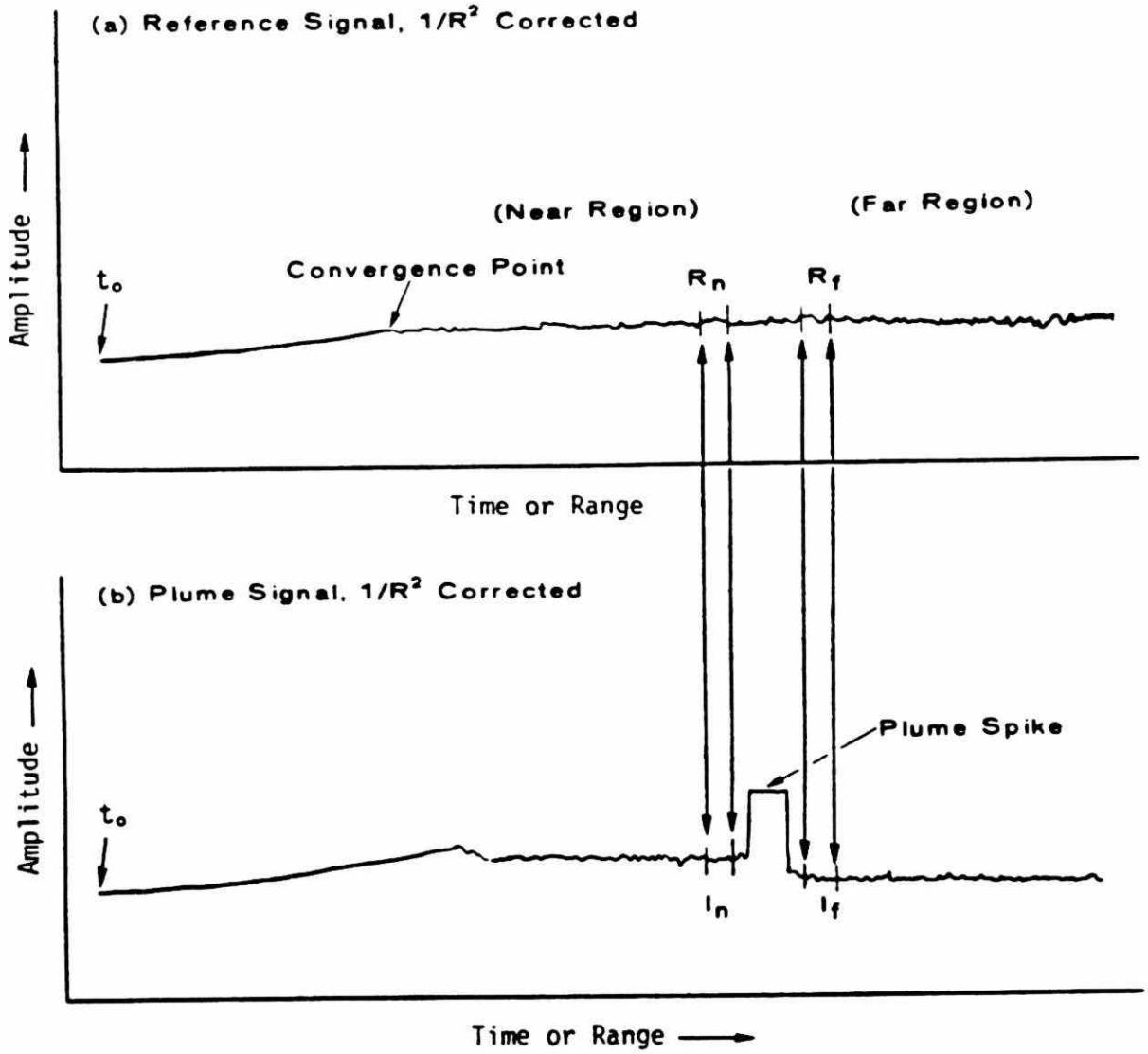
	1	2	3	4	5	6	7	8
Calibrated opacity								
Calculated opacity								
Recorded on file								

OPERATOR'S SIGNATURE ______ DATE ______

WITNESS SIGNATURE ______ DATE ______

Figure AM1-II Lidar Log Of Operations

[Appendix A, Method 9]



(a) Reference signal, $1/R^2$-corrected. This reference signal is for plume signal (b). R_n, R_f are chosen to coincide with I_n, I_f.

(b) Plume signal, $1/R^2$-corrected. The plume spike and the decrease in the backscatter signal amplitude in the far region are due to the opacity of the plume. I_n, I_f are chosen as indicated in Section 2.6.

Figure AM1-III. Plots of Lidar Backscatter Signals

2.6 Opacity Calculation and Data Analysis. Referring to the reference signal and plume signal in Figure AM1-III, the measured opacity (O_p) in percent for each lidar measurement is calculated using Equation AM1-2. ($O_p = 1 - T_p$; T_p is the plume transmittance.)

[2.6 corrected by 47 FR 28624, July 1, 1982]

$$O_p = (100\%)\left[1 - \left(\frac{I_f}{R_f}\frac{R_n}{I_n}\right)^{1/2}\right], \qquad \text{(AM1-2)}$$

where:

I_n = near-region pick interval signal amplitude, plume signal, $1/R^2$ corrected.

I_f = far-region pick interval signal amplitude, plume signal, $1/R^2$ corrected.

R_n = near-region pick interval signal amplitude, reference signal, $1/R^2$ corrected, and

R_f = far-region pick interval signal amplitude, reference signal, $1/R^2$ corrected.

The $1/R^2$ correction to the plume and reference signal amplitudes is made by multiplying the amplitude for each successive sample interval from the time reference, by the square of the lidar time (or range) associated with that sample interval [Reference 5.1].

The first step in selecting the pick intervals for Equation AM1-2 is to divide the plume signal amplitude by the reference signal amplitude at the same respective ranges to obtain a "normalized" signal. The pick intervals selected using this normalized signal, are a minimum of 15 m (100 nanoseconds) in length and consist of at least 5 contiguous sample intervals. In addition, the following criteria, listed in order of importance, govern pick interval selection. (1) The intervals shall be in a region of the normalized signal where the reference signal meets the requirements of Section 2.3 and is everywhere greater than zero. (2) The intervals (near and far) with the minimum average amplitude are chosen. (3) If more than one interval with the same minimum average amplitude is found, the interval closest to the plume is chosen. (4) The standard deviation, S_o, for the calculated opacity shall be 8% or less. (S_o is calculated by Equation AM1-7).

If S_o is greater than 8%, then the far pick interval shall be changed to the next interval of minimal average amplitude. If S_o is still greater than 8%, then this procedure is repeated for the far pick interval. This procedure may be repeated once again for the near pick interval, but if S_o remains greater than 8%, the plume signal shall be discarded.

The reference signal pick intervals, R_n and R_f, must be chosen over the same time interval as the plume signal pick intervals, I_n and I_f, respectively [Figure AM1-III]. Other methods of selecting pick intervals may be used if they give equivalent results. Field-oriented examples of pick interval selection are available in Reference 5.1.

The average amplitudes for each of the pick intervals, I_n, I_f, R_n, R_f, shall be calculated by averaging the respective individual amplitudes of the sample intervals from the plume signal and the associated reference signal each corrected for $1/R^2$. The amplitude of I_n shall be calculated according to Equation (AM-3).

$$I_n = \frac{1}{m}\sum_{i=1}^{m} I_{ni}, \qquad \text{(AM1-3)}$$

where:

I_{ni} = the amplitude of the ith sample interval (near-region).

Σ = sum of the individual amplitudes for the sample intervals,

m = number of sample intervals in the pick interval, and

I_n = average amplitude of the near-region pick interval.

Similarly, the amplitudes for I_f, R_n, and R_f are calculated with the three expressions in Equation (AM1-4).

$$I_f = \frac{1}{m}\sum_{i=1}^{m} I_{fi}, \quad R_n = \frac{1}{m}\sum_{i=1}^{m} R_{ni}, \quad R_f = \frac{1}{m}\sum_{i=1}^{m} R_{fi}. \qquad \text{(AM1-4)}$$

The standard deviation, S_{In}, of the set of amplitudes for the near-region pick interval, I_n, shall be calculated using Equation (AM1-5).

$$S_{In} = \left[\sum_{i=1}^{m} \frac{(I_{ni} - I_n)^2}{(m-1)}\right]^{1/2}. \qquad \text{(AM1-5)}$$

Similarly, the standard deviations S_{If}, S_{Rn}, and S_{Rf} are calculated with the three expressions in Equation (AM1-6).

$$S_{If} = \left[\sum_{i=1}^{m} \frac{(I_{fi} - I_f)^2}{(m-1)}\right]^{1/2}, \quad S_{Rn} = \left[\sum_{i=1}^{m} \frac{(R_{ni} - R_n)^2}{(m-1)}\right]^{1/2},$$

$$S_{Rf} = \left[\sum_{i=1}^{m} \frac{(R_{fi} - R_f)^2}{(m-1)}\right]^{1/2}. \qquad \text{(AM1-6)}$$

The standard deviation, S_o, for each associated opacity value, O_p, shall be calculated using Equation (AM1-7).

$$S_o = \frac{(100\%)}{2}\left(\frac{I_f}{R_f}\frac{R_n}{I_n}\right)^{1/2}\left[\frac{S_{In}^2}{I_n^2} + \frac{S_{If}^2}{I_f^2} + \frac{S_{Rn}^2}{R_n^2} + \frac{S_{Rf}^2}{R_f^2}\right]^{1/2} \qquad \text{(AM1-7)}$$

[Equation AM1-7 corrected by 47 FR 28624, July 1, 1982]

The calculated values of I_n, I_f, R_n, R_f, S_{In}, S_{If}, S_{Rn}, S_{Rf}, O_p, and S_o should be recorded. Any plume signal with an S_o greater than 8% shall be discarded.

2.6.1 Azimuth Angle Correction. If the azimuth angle correction to opacity specified in this section is performed, then the elevation angle correction specified in Section 2.6.2 shall not be performed. When opacity is measured in the residual region of an attached steam plume, and the lidar line-of-sight is not perpendicular to the plume, it may be necessary to correct the opacity measured by the lidar to obtain the opacity that would be measured on a path perpendicular to the plume. The following method, or any other method which produces equivalent results, shall be used to determine the need for a correction, to calculate the correction, and to document the point within the plume at which the opacity was measured.

Figure AM1-IV(b) shows the geometry of the opacity correction. L' is the path through the plume along which the opacity measurement is made. P' is the path perpendicular to the plume at the same point. The angle ϵ is the angle between L' and the plume center line. The angle $(\pi/2\text{-}\epsilon)$, is the angle between the L' and P'. The measured opacity, O_p, measured along the path L' shall be corrected to obtain the corrected opacity, O_{pc}, for the path P', using Equation (AM1-8).

$$O_{pc} = (100\%)\left[1 - (1 - 0.01\,O_p)^{\cos(\pi/2-\epsilon)}\right]$$

$$= (100\%)\left[1 - (1 - 0.01\,O_p)^{\sin\epsilon}\right] \qquad \text{(AM1-8)}$$

[Equation AM1-8 corrected by 47 FR 28624, July 1, 1982]

The correction in Equation (AM1-8) shall be performed if the inequality in Equation (AM1-9) is true.

$$\epsilon \geq \sin^{-1}\left[\frac{\ln(101 - O_p)}{\ln(100 - O_p)}\right] \qquad \text{(AM1-9)}$$

[Equation AM1-9 corrected by 47 FR 28624, July 1, 1982]

Figure AM1-IV(a) shows the geometry used to calculate ϵ and the position in the plume at which the lidar measurement is made. This analysis assumes that for a given lidar measurement, the range from the lidar to the plume, the elevation angle of the lidar from the horizontal plane, and the azimuth angle of the lidar from an arbitrary fixed reference in the horizontal plane can all be obtained directly.

[Appendix A, Method 9]

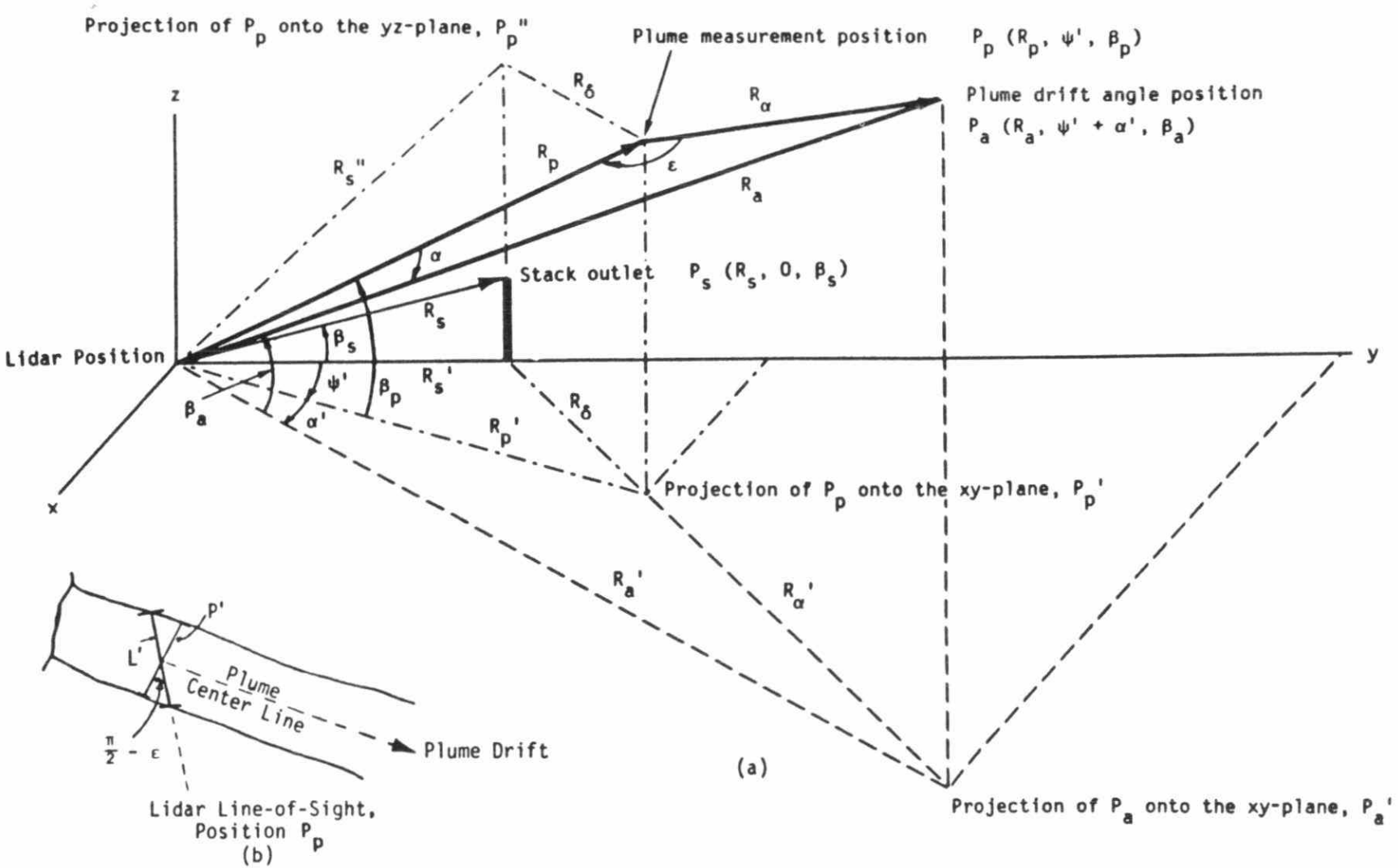


Figure AMI - IV. Correction in Opacity for Drift of the Residual Region of an Attached Steam Plume.

R_s = range from lidar to source*
β_s = elevation angle of R_s*
R_p = range from lidar to plume at the opacity measurement point*
β_p = elevation angle of R_p*
R_a = range from lidar to plume at some arbitrary point, P_a, so the drift angle of the plume can be determined*
β_a = elevation angle of R_a*
α = angle between R_a and R_s

R'_s = projection of R_s in the horizontal plane
R'_p = projection of R_p in the horizontal plane
R'_a = projection of R_a in the horizontal plane
ψ' = angle between R'_s and R'_p*
α' = angle between R'p and R'a*
R_δ distance from the source to the opacity measurement point projected in the horizontal plane

[corrected by 47 FR 28624, July 1, 1982]

R_δ = distance from opacity measurement point P_p to the point in the plume P_p

$$\epsilon = \text{Sin}^{-1}\left[\frac{R_a \text{Sin}\alpha}{R_\alpha}\right], \quad \text{(AM1-10)}$$

[Corrected by 47 FR 28624, July 1, 1982]

The correction angle ϵ shall be determined using Equation AM1-10.
where:
$\alpha = \text{Cos}^{-1}\{\text{Cos}\beta_p \text{Cos}\beta_a \text{Cos}\alpha' + \text{Sin}\beta_p \text{Sin}\beta_a\}$.
and

$R_\delta = (R_p^2 + R_a^2 - 2R_pR_a \text{Cos}\alpha')^{1/2}$
[Corrected by 47 FR 28624, July 1, 1982]

R_δ the distance from the source to the opacity measurement point projected in the horizontal plane, shall be determined using Equation AM1-11.

[corrected by 47 FR 28624, July 1, 1982]

$$R_\delta = (R'^2_s + R'^2_p - 2R'_sR'_p\text{Cos}\psi')^{1/2}, \quad \text{(AM1-11)}$$

where:
$R'_s = R_s \text{Cos}\beta_s$, and
$R'_p = R_p \text{Cos}\beta_p$.

In the special case where the plume centerline at the opacity measurement point is horizontal, parallel to the ground, Equation AM1-12 may be used to determine ϵ instead of Equation AM1-10.

$$\epsilon = \text{Cos}^{-1}\left[\frac{R_p^2 + R_\delta^2 - R''^2_s}{2R_pR_\delta}\right] \quad \text{(AM1-12)}$$

[Equation AM1-12 corrected by 47 FR 28624, July 1, 1982]

where:
$R''_s = (R'^2_s + R_p^2 \text{Sin}^2\beta_p)^{1/2}$.

If the angle ϵ is such that ϵ < 30 or ϵ > 150°, the azimuth angle correction shall not be performed and the associated opacity value shall be discarded.

2.6.2 Elevation Angle Correction. An individual lidar-measured opacity, O_p, shall be corrected for elevation angle if the laser elevation or inclination angle, β_p [Figure AM1-V], is greater than or equal to the value calculated in Equation AM1-13.

$$\beta_p \geq \text{Cos}^{-1}\left[\frac{\ln(101 - O_p)}{\ln(100 - O_p)}\right] \quad \text{(AM1-13)}$$

[Equation AM1-13 corrected by 47 FR 28624, July 1, 1982]

The measured opacity, O_p, along the lidar path L, is adjusted to obtain the corrected opacity, O_{pc}, for the actual plume (horizontal) path, P, by using Equation (AM1-14).

$$O_{pc} = (100\%)\left[1 - (1 - 0.01\,O_p)^{\text{Cos}\beta_p}\right], \quad \text{(AM1-14)}$$

[Equation AM1-14 corrected by 47 FR 28624, July 1, 1982]

where:
β_p = lidar elevation or inclination angle,
O_p = measured opacity along path L, and
O_{pc} = corrected opacity for the actual plume thickness P.

The values for β_p, O_p and O_{pc} should be recorded.

*Obtained directly from lidar. These values should be recorded.

[Appendix A, Method 9]

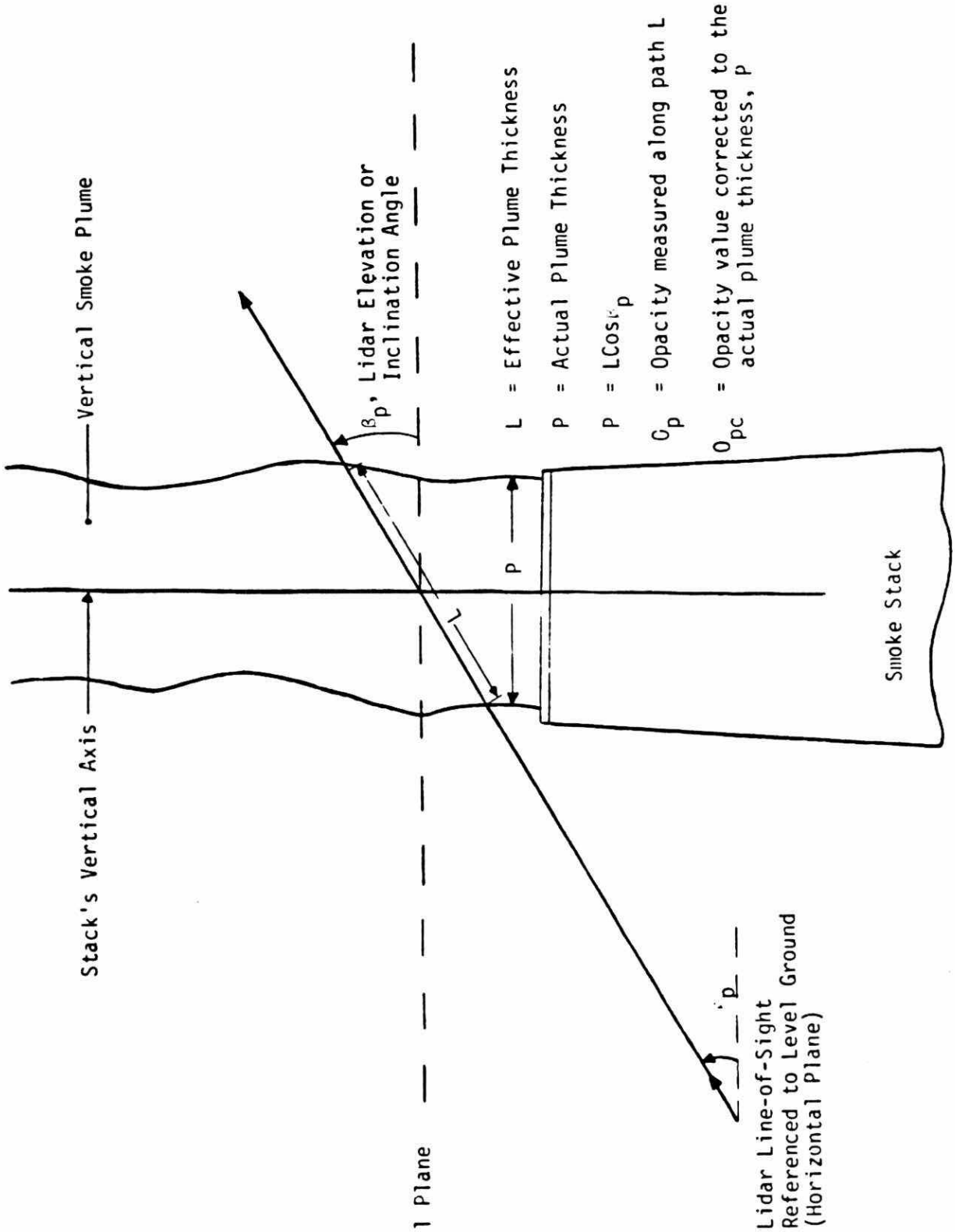


Figure AM1-V. Elevation Angle Correction for Vertical Plumes.

[Appendix A, Method 9]

2.6.3 Determination of Actual Plume Opacity. Actual opacity of the plume shall be determined by Equation AM1-15.

$$O_{pa} = O_{pc} - [2\,S_o + 5\%]. \qquad \text{(AM1-15)}$$

2.6.4 Calculation of Average Actual Plume Opacity. The average of the actual plume opacity, $\bar{O}_{pa}$, shall be calculated as the average of the consecutive individual actual opacity values, O_{pa}, by Equation AM1-16.

$$\bar{O}_{pa} = \frac{1}{n}\sum_{k=1}^{n} (O_{pa})_k \,. \qquad \text{(AM1-16)}$$

where:

$(O_{pa})_k$ = the kth actual opacity value in an averaging interval containing n opacity values: k is a summing index.

Σ = the sum of the individual actual opacity values.

n = the number of individual actual opacity values contained in the averaging interval.

$\bar{O}_{pa}$ = average actual opacity calculated over the averaging interval.

3. Lidar Performance Verification. The lidar shall be subjected to two types of performance verifications that shall be peformed in the field. The annual calibration, conducted at least once a year, shall be used to directly verify operation and performance of the entire lidar system. The routine verification, conducted for each emission source measured, shall be used to insure proper performance of the optical receiver and associated electronics.

3.1 Annual Calibration Procedures. Either a plume from a smoke generator or screen targets shall be used to conduct this calibration.

If the screen target method is selected, five screens shall be fabricated by placing an opaque mesh material over a narrow frame (wood, metal extrusion, etc.). The screen shall have a surface area of at least one square meter. The screen material should be chosen for precise optical opacities of about 10, 20, 40, 60, and 80%. Opacity of each target shall be optically determined and should be recorded. If a smoke generator plume is selected, it shall meet the requirements of Section 3.3 of Reference Method 9. This calibration shall be performed in the field during calm (as practical) atmospheric conditions. The lidar shall be positioned in accordance with Section 2.1.

The screen targets must be placed perpendicular to and coincident with the lidar line-of-sight at sufficient height above the ground (suggest about 30 ft) to avoid ground-level dust contamination. Reference signals shall be obtained just prior to conducting the calibration test.

The lidar shall be aimed through the center of the plume within 1 stack diameter of the exit, or through the geometric center of the screen target selected. The lidar shall be set in operation for a 6-minute data run at a nominal pulse rate of 1 pulse every 10 seconds. Each backscatter return signal and each respective opacity value obtained from the smoke generator transmissometer, shall be obtained in temporal coincidence. The data shall be analyzed and reduced in accordance with Section 2.6 of this method. This calibration shall be performed for 0% (clean air), and at least five other opacities (nominally 10, 20, 40, 60, and 80%).

The average of the lidar opacity values obtained during a 6-minute calibration run shall be calculated and should be recorded. Also the average of the opacity values obtained from the smoke generator transmissometer for the same 6-minute run shall be calculated and should be recorded.

Alternate calibration procedures that do not meet the above requirements but produce equivalent results may be used.

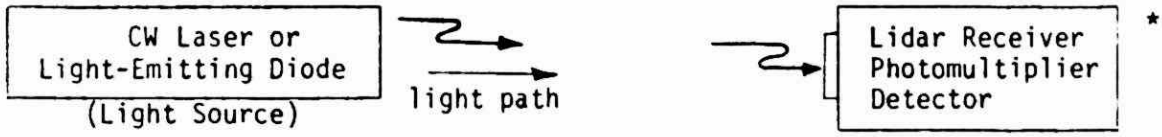
3.2 Routine Verification Procedures. Either one of two techniques shall be used to conduct this verification. It shall be performed at least once every 4 hours for each emission source measured. The following parameters shall be directly verified.

1) The opacity value of 0% plus a minimum of 5 (nominally 10, 20, 40, 60, and 80%) opacity values shall be verified through the PMT detector and data processing electronics.

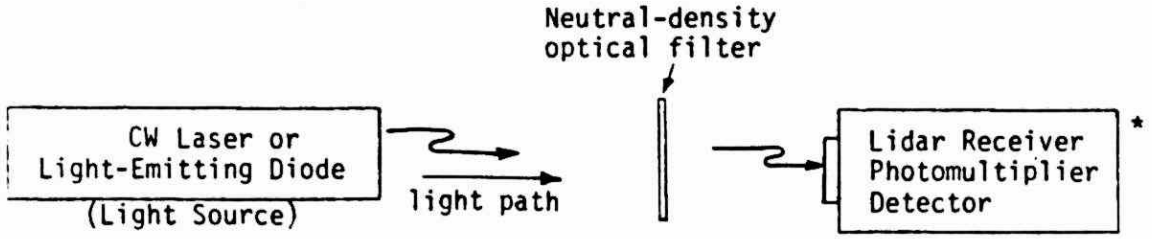
2) The zero-signal level (receiver signal with no optical signal from the source present) shall be inspected to insure that no spurious noise is present in the signal. With the entire lidar receiver and analog/digital electronics turned on and adjusted for normal operating performance, the following procedures shall be used for Techniques 1 and 2, respectively.

3.2.1 Procedure for Technique 1. This test shall be performed with no ambient or stray light reaching the PMT detector. The narrow band filter (694.3 nanometers peak) shall be removed from its position in front of the PMT detector. Neutral density filters of nominal opacities of 10, 20, 40, 60, and 80% shall be used. The recommended test configuration is depicted in Figure AM1-VI.

(a) Zero-Signal Level Test



(b) Clear-Air or 0% Opacity Test



(c) Optical Filter Test (simulated opacity values)

*Tests shall be performed with no ambient or stray light reaching the detector.

Figure AM1-VI. Test Configuration for Technique 1.

The zero-signal level shall be measured and should be recorded, as indicated in Figure AM1-VI(a). This simulated clear-air or 0% opacity value shall be tested in using the selected light source depicted in Figure AM1-VI(b).

The light source either shall be a continuous wave (CW) laser with the beam mechanically chopped or a light emitting diode controlled with a pulse generator (rectangular pulse). (A laser beam may have to be attenuated so as not to saturate the PMT detector). This signal level shall be measured and should be recorded. The opacity value is calculated by taking two pick intervals (Section 2.6) about 1 microsecond apart in time and using Equation (AM1-2) setting the ratio $R_n/R_f=1$. This calculated value should be recorded.

The simulated clear-air signal level is also employed in the optical test using the neutral density filters. Using the test configuration in Figure AM1-VI(c), each neutral density filter shall be separately placed into the light path from the light source to the PMT detector. The signal level shall be measured and should be recorded. The opacity value for each filter is calculated by taking the signal level for that respective filter (I_f), dividing it by the 0% opacity signal level (I_n) and performing the remainder of the calculation by Equation (AM1-2) with $R_n/R_f=1$. The calculated opacity value for each filter should be recorded.

The neutral density filters used for Technique 1 shall be calibrated for actual opacity with accuracy of ±2% or better. This calibration shall be done monthly while the filters are in use and the calibrated values should be recorded.

3.2.2 Procedure for Technique 2. An optical generator (built-in calibration mechanism) that contains a light-emitting diode (red light for a lidar containing a ruby laser) is used. By injecting an optical signal into the lidar receiver immediately ahead of the PMT detector, a backscatter signal is simulated. With the entire lidar receiver electronics turned on and adjusted for normal operating performance, the optical generator is turned on and the simulation signal (corrected for $1/R^2$) is selected with no plume spike signal and with the opacity value equal to 0%. This simulated clear-air atmospheric return signal is displayed on the system's video display. The lidar operator then makes any fine adjustments that may be necessary to maintain the system's normal operating range.

The opacity values of 0% and the other five values are selected one at a time in any order. The simulated return signal data should be recorded. The opacity value shall be calculated. This measurement/calculation shall be performed at least three times for each selected opacity value. While the order is not important, each of the opacity values from the optical generator shall be verified. The calibrated optical generator opacity value for each selection should be recorded.

The optical generator used for Technique 2 shall be calibrated for actual opacity with an accuracy of ±1% or better. This calibration shall be done monthly while the generator is in use and calibrated value should be recorded.

Alternate verification procedures that do not meet the above requirements but produce equivalent results may be used.

3.3 Deviation. The permissible error for the annual calibration and routine verification are:

3.3.1 Annual Calibration Deviation.

3.3.1.1 Smoke Generator. If the lidar-measured average opacity for each data run is not within ±5% (full scale) of the respective smoke generator's average opacity over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.1.2 Screens. If the lidar-measured average opacity for each data run is not within ±3% (full scale) of the laboratory-determined opacity for each respective simulation screen target over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.2 Routine Verification Error. If the lidar-measured average opacity for each neutral density filter (Technique 1) or optical generator selection (Technique 2) is not within ±3% (full scale) of the respective laboratory calibration value then the lidar shall be considered non-operational.

4. Performance/Design Specification for Basic Lidar System.

4.1 Lidar Design Specification. The essential components of the basic lidar system are a pulsed laser (transmitter), optical receiver, detector, signal processor, recorder, and an aiming device that is used in aiming the lidar transmitter and receiver. Figure AM1-VII shows a functional block diagram of a basic lidar system.

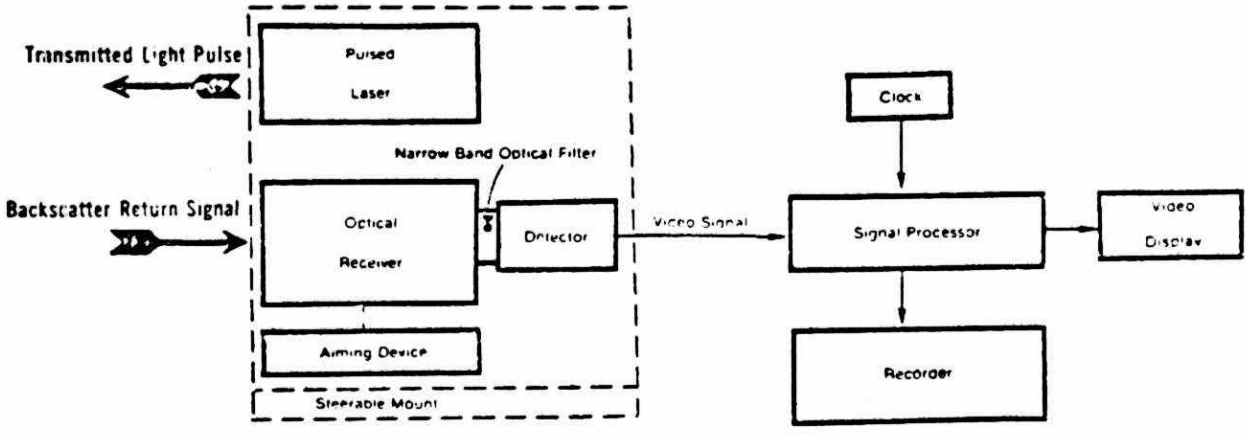


Figure AM1-VII. Functional Block Diagram of a Basic Lidar System

[Appendix A, Method 9]

4.2 Performance Evaluation Tests. The owner of a lidar system shall subject such a lidar system to the performance verification tests described in Section 3. prior to first use of this method. The annual calibration shall be performed for three separate, complete runs and the results of each should be recorded. The requirements of Section 3.3.1 must be fulfilled for each of the three runs.

[4.2 corrected by 47 FR 28624, July 1, 1982]

Once the conditions of the annual calibration are fulfilled the lidar shall be subjected to the routine verification for three separate complete runs. The requirements of Section 3.3.2 must be fulfilled for each of the three runs and the results should be recorded. The Administrator may request that the results of the performance evaluation be submitted for review.

5. References.

5.1 The Use of Lidar for Emissions Source Opacity Determination, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO, EPA-330/1-79-003-R, Arthur W. Dybdahl, current edition [NTIS No. PB81-246662].

5.2 Field Evaluation of Mobile Lidar for the Measurement of Smoke Plume Opacity, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO, EPA/NEIC-TS-128, February 1976.

5.3 Remote Measurement of Smoke Plume Transmittance Using Lidar, C. S. Cook, G. W. Bethke, W. D. Conner (EPA/RTP), Applied Optics 11, pg 1742, August 1972.

5.4 Lidar Studies of Stack Plumes in Rural and Urban Environments, EPA-650/4-73-002, October 1973.

5.5 American National Standard for the Safe Use of Lasers ANSI Z 136.1-176, 8 March 1976.

5.6 U.S. Army Technical Manual TB MED 279, Control of Hazards to Health from Laser Radiation, February 1969.

5.7 Laser Institute of America Laser Safety Manual, 4th Edition.

5.8 U.S. Department of Health, Education and Welfare, Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968, January 1976.

5.9 Laser Safety Handbook, Alex Mallow, Leon Chabot, Van Nostrand Reinhold Co., 1978.

APPENDIX E

REVIEW OF U.S. APPROACHES TO CONTROL TECHNOLOGY

Review of U.S. Approaches to Control Technology

(BACT) - Best Available Control Technology

The concept of emission controls is widely used in the U.S. Under the 1977 Clean Air Act amendments, Best Available Control Technology (BACT) is required on installations for all pollutants subject to National Ambient Air Quality Standards (NAAQS), Standards of Performance for New Stationary Sources (SPNSS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and Emission Standards for Moving Sources (ESMS). BACT is determined on a case-by-case basis, an approach which provides flexibility at the cost of consistency in what is acceptable from one administrative area to another. The approach used to determine BACT in each particular case is consistent. It should be noted that the minimum BACT determination is provided by the NSPS and NESHAP guidelines, while the maximum BACT determination is fixed by such items as the size of the plant, the amount of the air quality increment that would be consumed and economic growth characteristics. The determination of BACT is the responsibility of the proponent who then has the onus of presenting and defending the technology selection.

Alternative systems that can achieve a higher degree of emission control, or different degrees of emission control, are required in a BACT application. Similarly, for each of these higher or different degrees of control the incremental energy, environmental and economic impacts are required.

(LAER) - Lowest Achievable Emission Rate

Lowest Achievable Emission Rates (LAERs) are applied to significant new or modified sources (defined by EPA as those emitting in excess of 1,000 lbs/day; 100 lbs/hour; or 50 tons of pollutant per annum) likely to cause or exacerbate non-attainment of National Ambient

Air Quality Standards (NAAQS). They are defined as the rate of emission which reflects the more stringent of two possible rates:

i) The most stringent emission limitation which is contained in the implementation plan of any state for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable;

ii) The most stringent emission limitation which is achieved in practice, or can reasonably be expected to occur in practice, by such class or category of source, taking into consideration the pollutant which must be controlled.

In no case must that rate exceed New Source Performance Standards (NSPS).

In the application of LAER, it was ruled that economic factors must be accorded "far less weight" than in the case of NSPS (see below) although the practical consequences of this are obscure. EPA has ruled that in cases where there is the possibility of transfers of control technology between different types of sources the reviewing authority should consider this but is not bound.

(NSPS) - New Source Performance Standards

New Source Performance Standards (NSPS) are emission standards for specific categories of new and modified sources promulgated by EPA under Section 111 of the Clean Air Act. These standards must reflect the degree of emission reduction achievable through the application of the best adequately demonstrated system for each category of sources. Economic, environmental and energy factors must be considered in evolving NSPS standards.

(NESHAP) - National Emission Standards for Hazardous Air Pollutants

National Emissions Standards for Hazardous Air Pollutants (NESHAP's) are limitations on designated, very hazardous air pollutant emissions (those shown to cause or contribute to an increase in serious irreversible or incapacitating reversible illness). They are set to provide an ample margin of safety to protect public health. Where emission limits are impractical E.P.A. may set design, equipment or operational standards or combinations of these.

(RACT) - Reasonably Available Control Technology

RACT applies only to existing sources and not to new or modified ones. Its particular significance in the U.S. framework is that under 1979 nonattainment, State Implementation Plan (SIP) revisions, it was required for sources in nonattainment areas. Its determination is on a case-by-case basis, but heavy emphasis is accorded to criteria contained in EPA's Control Techniques Guideline Documents.

APPENDIX F

DERIVATION AND SIGNIFICANCE OF MOE "UPPER LIMITS OF NORMAL" CONTAMINANT GUIDELINES

Ministry of the Environment
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DERIVATION AND SIGNIFICANCE OF MOE "UPPER LIMITS OF NORMAL" CONTAMINANT GUIDELINES

The MOE "upper limits of normal" contaminant guidelines shown in the attached table essentially represent the expected maximum concentrations of contaminants in surface soil (non-agricultural), foliage (deciduous and current year coniferous trees and shrubs), grass, moss bags and/or snow from areas of Ontario not subject to the influence of point sources of emissions. "Urban" guidelines are based upon samples collected from centres of minimum 10,000 population. "Rural" guidelines are based upon samples collected from non-built-up areas. Samples were collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch; Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant concentration results for samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are "non-normal", the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples. Geometric means were not employed in calculating the guidelines because: 1) tests of two representative non-normal distributions showed that normality was not significantly improved by using log-transformed data, and 2) the guideline concentrations calculated using the geometric mean were considerably higher than the maximum observed concentrations.

Due to the large variability in element concentrations which may be present across Ontario, even in background data, control samples should always be collected. This is particularly important for soils, which may show large regional variations in element composition due to differences in parent material. Species of vegetation which naturally accumulate high levels of an element also may be encountered.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of above-normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines would not normally be considered toxic. A brief review of world literature has shown that the guideline concentrations are generally within the ranges of results reported by other investigators.

The table of guidelines will be expanded and revised as more data become available.

(August, 1986)

PH74/12

Contaminant Guidelines Representing Upper Limits of Normal Concentrations (ppm, dry weight) of Parameters in Soil, Foliage, Grass, Moss Bags and Snow in Ontario (Urban and Rural).

The guidelines are approximately equal to the mean of the data plus three standard deviations.

Parameter	Soil (0-5 cm) Urban	Soil (0-5 cm) Rural	Foliage (unwashed) Urban	Foliage (unwashed) Rural	Grass (unwashed) Rural	Moss Bags++ Urban	Moss Bags++ Rural	Snow+++ Rural
Aluminum	a	a	500***	500	a	a	1700	0.6
Antimony	8	1**	0.5**	0.3**	a	2	a	a
Arsenic	20	10	2	0.5, 2*	c, 8*	2	1	0.04
Boron	15	10**	175	75	20	a	a	a
Cadmium	4	3, 4*	3+	1+	0.5, 2*	4	2	0.003
Calcium	b	b	a	3%	a	a	a	2
Chloride	a	a	b	0.15%	1%	a	0.03%	4
Chromium	50	50	8	8	5	7	a	a
Cobalt	25***	25	2***	2	2, 8*	6	a	c
Copper	100	60	20	20	7, 20*	60	8	0.06
Fluoride	a	a	35	15	12	a	45	a
Iron	3.5%***	3.5%	1000	500	500	3000	1700	0.7
Lead	500	150	60	30	20	200	35	0.07
Magnesium	a	1%	0.7%	0.7%	a	a	a	0.4
Manganese	700	700,1000*	b	b	50, a*	a	a	a
Mercury	0.5	0.15	0.3	0.1	a	a	0.2	0.0001**
Molybdenum	3	2**	1.5	1.5	6	a	a	a
Nickel	60***	60	7	5, 30*	5, 25*	13	6	0.04
Nitrogen	a	a	b	b	b	a	a	1 (as nitrate)
Phosphorus	a	a	a	a	a	a	a	0.04
Potassium	a	d	a	a	a	a	a	1
Selenium	2	2	0.7	0.5	0.5	a	0.6	a
Silver	c	a	a	a	a	a	a	a
Sodium	a	a	350	50	a	a	b	2
Sulphur	a	0.1%	0.4%	0.4%	0.5%	a	0.1%	3 (as sulphate)
Vanadium	70	70	5***	5	6	a	c	a
Zinc	500	500	250***	250+	40, 100*	800	100	0.3
Alkalinity	n.a	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.5
Conductivity	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	60
Suspended Solids	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	30

Notes:

* Where two values are shown, the first is based mainly on Southern Ontario data while the second is based on NE Region data. Also, there are indications that some of the guidelines, at least for foliage, may be somewhat liberal for the NW Region. THESE GUIDELINES ARE MEANT TO SUPPLEMENT, RATHER THAN REPLACE, SPECIFIC CONTROL DATA.

** Provisional guideline estimated from range of results, pending additional data.

*** Rural results higher than urban results - urban guideline based on rural results.

+ Data for species considered to be accumulators (Populus spp., Betula spp., Salix spp.) excluded.

++ Moss bag guidelines based on 30 day exposure. No data from NE Region.

+++ Snow guidelines are mg/l of meltwater, except conductivity which is µmhos/cm. Based mainly on NW and NE Region data.

a Sample size insufficient (< 30) to establish guideline.

b Concentration highly variable - guideline not established.

c 50% or more of results less than detection limit - guideline not established.

d Discrepancy between Ontario data and literature values - guideline not established.

n.a. not applicable.

rev. Aug./86

APPENDIX G

PROCEEDINGS OF AIR POLLUTION GENERAL REGULATION WORKSHOP
NOVEMBER 14th/15th 1985

PROCEEDINGS OF AIR POLLUTION

GENERAL REGULATION WORKSHOP

NOV. 14th/15th 1985

March 1986

AIR MANAGEMENT WORKSHOP
REGULATION 308 REVIEW
November 14-15, 1985

Thursday, November 14th

OPENING REMARKS

Dr. David Balsillie: (Director, Air Resources Branch)

It's not by accident that you are here today. You represent a number of diverse groups; various levels of government, industry, and interest groups. Some of you are academics and some lawyers. All of you have something to add to this process. You've been selected because you are familiar, on a day-to-day basis, with Regulation 308. You know some of its good points and most of its shortcomings. You are a select group; we respect your opinions and want to hear them.

I want to emphasize at the outset the openness of this process. You know the old saying, "trust me, I'm from the government, I'm here to help you". One gentleman already said that if we told the truth right away then we wouldn't be suspect. However, I'm telling you the truth when I say that we have no preconceived notions. We've invited you to give us your opinions. You're experts in your field and we want to know what you have to say about Regulation 308 and where it ought to go. We have conducted an internal review in order to give some structure to this operation. We had to have some idea of the things we need to stress and the things we need to find out. There is no draft Regulation back in my office waiting to be propped up onto the table on Tuesday morning. This process will continue for the next nine months to a year and this is literally the first stage. The purpose of this workshop is to review Regulation 308 and provide guidance to the Ministry of the Environment which will re-write the Regulation and then circulate it for further review and comment. We need your input. I can't stress this too much.

I hope the material we sent to you was comprehensive without being overwhelming. I apologize that we did not send it to you sooner, but staff are working

to tight deadlines and we got it to you as soon as we could. I'm not sure whether your schedules are any better than ours, so if we had sent it to you six weeks ahead of time, instead of two, I'm not sure that you would have spent more time on it than you did. However, it's very important that you have read the information and are prepared to contribute to this workshop.

I would like to make a few acknowledgments as to how we got to this point in the process. I want to introduce Chester Duncan who is sitting on my left. He is Manager of the Emission Technology and Regulation Development Section within the Air Resources Branch. He has been the driving force behind this process for the last two or three years. Two people that you may already have talked to are John Hewings and Florence Brill. They have been responsible for getting this material together, distributing it and arranging many details of this workshop. Another important person is Murray Cheetham. Murray is from the Communications Branch and has made all the physical arrangements here at the hotel, including our dinners, banquets, lunches, etc. and I wish to thank Murray for all he has done.

This review has been carried out under the direction of Mr. David Redgrave, who is the Assistant Deputy Minister of the Environmental Programs Support Services Division. The Steering Committee was made up of several directors from the Ministry; myself as Chairman, Erv McIntyre of Approvals Branch, Boris Boyko from West Central Region, Ivy Wile from Hazardous Contaminants, Ron Gotts from Waste Management and Andre Castel from Policy & Planning Branch. These people are also expected to be here for some of the plenary sessions and the dinner this evening.

In a way, this meeting is a historical occasion. Chester, I and others at the Ministry are very excited about the possibility of what can come out of this. We have to agree that this is not necessarily a constitutional conference, but we're at the end

of an era with regard to this Air Pollution Regulation. As you will remember, from reading the material which was handed out to you, the General Air Regulation was developed in 1967-68 under the old Air Pollution Control Act. Although it's been revised occasionally, the philosophy of point of impingement and control of air pollutants based on effects has remained the central focal point of that Regulation for many years.

It's fitting that a number of the original architects of that Regulation are here today. I would like to point out Mr. Brad Drowley. Brad has been termed the father of air pollution control in this province. I think everybody knows Brad and we are pleased to have him with us. I believe Bill Moroz was in on that first legislation. He is now with Ontario Hydro and we are pleased to have Bill with us. Jim Fry is still with the Ministry of the Environment. Are there any others I have overlooked who were with the Ministry back in 1967-68 putting together that legislation? Those three I know. I'd like to show some slides to review the processes that led us here and I will introduce you to the rest of the staff, people who will help you during the next two days and then we'll get on with the workshop.

This whole process started out as the Air Management Program Review back in 1983. Chester Duncan came to the Air Resources Branch to work specifically on this program. He guided the internal review and brought this workshop to fruition. The goal of the program was "to review, update and develop necessary policies and guidelines to enable the Ministry of the Environment to better manage the air quality within the Province of Ontario". Not that it hasn't been well managed in the past but there is always room for improvement. This is the organization chart and you'll recognize it from your booklet. It has the Assistant Deputy Minister, David Redgrave, to whom I have referred already; the Steering Committee made up of Ministry directors; on one side liaison with other government agencies and on the other, liaison with industry and public, and that's why we are here today. Then we have the Air

Management Program Review. The objectives of the review, were to: outline the history and philosophy; find out where we've been; look at legislative review and development (that's the portion we are here to look at today); develop policies; look at source testing and emission control procedures; look at what we are doing with ambient air monitoring and how it might be improved; and look at research and special projects. So this program, the legislative review and developments, is what we are going to focus on. The Air Management Program had several objectives and the second one is Legislative Review and Development. Several acts and regulations were to be examined and seven work groups were established with regard to this legislative review. All acts and regulations relevant to Air Management in Ontario were looked at; first the Environmental Protection Act and then the others. There are special Regulations under the Act, the major one being the General Air Pollution Regulation, Regulation 308 and the one we are especially interested in today and tomorrow. So we have the seven working groups. Working Group One looked mainly at definitions, and updated the existing list of standards. It recommended several changes and, of course, we are all going metric, so we can use kilo pascals, joules and some other measures that most of us don't quite talk in, but are now becoming more familiar with.

Working Group Two reviewed the present Air Pollution Index, which is the index for sulfur dioxide and particulates and the one you hear on the radio quite frequently in seven cities across the province. It also looked at the new Air Quality Index. We will be hearing considerably more about this new index which will give more information on seven pollutants, including the existing API, in over 20 cities across the province. We are recommending that we not change the Air Pollution Index as it has a regulatory function attached to it. The new Air Quality Index will be an information tool and not regulatory. It will keep the public better informed on the level of air quality in their community.

Working Group Three reviewed the use of dispersion equations in the legislation, the heart of the matter. This embodies the philosophy of Air Management within the province and the working group met several times. They met for two days in a row at one time. I think some friendships were nearly severed, but they recommended the best reasonable technology approach with state-of-the-art ambient air modelling. That was the working group's recommendation. Whether it's the recommendation of this workshop after two days remains to be seen.

Working Group Four discussed the fact that long-range transport and deposition are not really addressed within the present Regulation 308. We have point of impingement standards and there are cases in which you can meet the hourly, 24-hourly or annual Ambient Air Quality numbers and over 15 years the deposition of materials in given areas may start to cause environmental degradation due to the build-up of that material. This group merged with Working Group Three so that long-range transport and deposition could be taken into account in the new philosophy that will be developed.

Review and update of phytotoxicological guidelines — I started out in phytotoxicology which means anything that damages plants. As you may know, Sam Linzon and his group are internationally famous for the work they have done using vegetation, soil, snow and moss bags as air quality indicators. They have come up with a set of guidelines which can be related to those monitoring devices. We're interested in including them in a regulation so we can use them as guidelines for monitoring various industries and emission sources.

Group Six was concerned with opacity. We've had some difficulties with opacity because when we started we had the smoke density chart. Many of you know about the chart. You hold up the chart and look at the smoke coming out of the chimney and say "Ah-Ha! It meets that one!" Then, when you get to court and hold up the chart, the

judge says, "What's that?" We've now moved towards the training and certification of inspectors who have "certified eyes". They know, when they look at an emission source, that the opacity is a given percentage and over the years develop expertise in this area. They then become certified experts when they go to court and we've had much better success with this. The Regulation needs to be changed somewhat in this area in order to take advantage of changes in technology or our methods of doing things.

Working Group Seven was a special group looking at incineration legislation in co-operation with the Waste Management Branch. This group didn't identify any present or future conflicts. We're working very well with our friends at the Waste Management Branch. There is a special group, again under Chester Duncan's direction, which is putting together an incineration policy for the Ministry of the Environment. We find an increasing need for this. There are many hearings related to energy from waste plants, other incinerators, bio-medical incinerators, etc. We need a policy and guideline to assist us in this area.

So what's being proposed for the future? I use the word proposed because it's not hard and fast. On one of the last pages of your agenda you'll see a very important item to be discussed in the third session - the process for proceeding to revise the regulation. We want to know what you think about who should be involved, at what stages and with regard to what sections. Once again we are looking for your input. This is a tentative process that we're putting before you.

We are holding a workshop today. We're going to review the material you supplied to us. As you see from the program, we are going to have people who will record what's going on at the various workshop sessions. The facilitator of each workshop will report back to Plenary Sessions. Murray Cheetham has the tape recorder rolling so that we'll have all the information you are giving to us verbatim.

It's important to make the distinction that the Ministry of the Environment, or the Government per se, is responsible for writing and producing the regulation. We have a responsibility to get it out for open review so we can incorporate the views and interests of everyone involved. We will have a draft regulation sometime down the road, then send it out and invite concerned groups to respond to it. We will then look for shortcomings which will have been identified in the regulation and make changes where necessary. Then it will be published. It says in the Ontario Gazette, but that is not the way Ontario Gazette works. It's not like the Canada Gazette where you publish a draft in Part I and then set out the Final version in Part II. The final draft will be published for general comment prior to promulgation. That's the general sequence of events. If you have any other suggestions or wish to see it in any other light, then we would like to hear from you.

I'd like to point out that the facilitators are facilitators. You are here to make these workshops go. The facilitator will not lead or guide you. He may have some stimulating thoughts and will try and keep you on track. The recorder is there to make sure that the information is recorded and to help the facilitator put together his remarks for the Plenary Session afterwards. If there is anything you want to get across or brought to the Plenary Session, make sure the recorder has it down the way you want it recorded.

The workshops per se are not taped. The Plenary Sessions are. I might say that if anyone wishes to speak at a Plenary Session - and I'm hoping that as we get to know each other better there will be a free flowing discussion - all speakers should go to the microphone so that they can be picked up by the tape recorder.

In group one, the facilitator is Mr. Les Fitz, Manager of Technical Support in Southeastern Region. He also served time in Sudbury and has a good background in abatement and is now looking after the monitoring portion of our program in the Southeastern region. Joel Kurtz is the recorder for that session. Joel is Air Quality Analyst with our Air Resources Branch.

For group two this morning Mr. Jim Fry, whom I mentioned earlier, is facilitator. He's still serving time in Sudbury. He's with our Northeastern Region as Manager of Technical Support. He also worked in Hamilton, so Jim has a good background in abatement as well as technical support. Ivan Rohac is the recorder for that session. He is an Engineer in our Vehicle Emissions Unit so if any of you want to ask questions about emissions from motor cars you can nab Ivan at coffee.

Facilitator for group three is Mr. Tom Armstrong. He is a Manager with the Approvals and Project Engineering Branch. Tom brings to us a background in abatement as well as technical support. Mr. George Nagy is the recorder. George is with the Regulations Development Unit of the Air Resources Branch.

For group four this morning, the facilitator is Mr. Mike Caranci. Mike is an Abatement Manager with our West Central Region at the Hamilton office. Mike has many years of abatement experience. Mr. Ken Smith, recorder, is a Senior Process Engineer Specialist with the Air Resources Branch.

There is one other facilitator tomorrow. Replacing Tom Armstrong is Mr. Barney Singh. Barney is an Abatement Manager with our Central Region and handles a number of hot topics like Junction Triangle and lead in South Riverdale. He brings a lot of experience to this meeting. He was also the Manager of Technical Support for several years. The recorder in that session is Dr. Akos Szakolcai. He's a Hazardous Contaminant Specialist in the Air Resources Branch.

I failed to mention that tomorrow Mr. Gary Wong, who is also here, will be the recorder for Group 1. Gary is a Source Assessment Engineer. He goes around climbing stacks, taking samples and making sure they get analyzed.

We have a number of resource people here because we felt there may be questions in your workshop. You may want to know specific details about various aspects. We therefore, have a number of people from the Ministry here and I'd like to introduce them. If you have any questions, these people are here to help us. Paul Complin is a Control & Process Technology Engineer in Chester's section. He was with the government and then went to the private sector for a while. Now he's back again and we're very pleased to have him with us today. Leo FitzPatrick, a solicitor with Legal Services Branch, has worked extensively on air regulations and we consider him our expert. We have two atmospheric modellers: Dr. Barbara Ley and Dr. P.K. Misra. They work together most of the time. They talk this goofy language that not too many of us understand, but we always like to know the bottom line and we are pleased to have them. I'll talk more about that in a moment. Rob Rinne is not here today. He had other things to do, but will be here tomorrow when the phytotoxicology guidelines are under discussion in the workshops. He's a specialist in levels of various elements, especially metals in vegetation, soils, snow and moss bags. We have two air pollution meteorologists with us who work together and are sitting together - Mr. Lou Shenfeld and Dr. David Yap. Akos Szakolcai, I have already introduced to you. He's not on your list, but we added him as a hazardous contaminant specialist and someone who is conversant with risk assessment and risk management, an area that I think will be part of your discussions over the next two days.

Finally, if you look at your agenda, you'll see that the workshops begin at 10 o'clock. It says Workshops starting with Section 5. That refers to Section 5 of Regulation 308 and the discussion topics are on this third page - agenda specifics. The first session is the heart of the matter. We are throwing you right into it. It starts with the philosophy of air management: point of impingement, best available technology, best reasonable technology, tall stacks and emission standards. How do you think we ought to go? There's a workshop for two hours. We'll have lunch in the Prince Ballroom South and following that, a session on modelling, which we felt was a

very important part of this process. A good portion of your yellow booklet was devoted to air pollution dispersion modelling and there may be some need to introduce and demonstrate this modelling activity in order to assist you in your deliberations. Therefore, we have asked Barbara Ley to put on a special demonstration of the proposed modelling activity (between 2 and 3 o'clock). There was a dry run last night and the facilitators were here along with the recorders and others. They asked quite a few questions so we're sure that you will also have some. It will help to put the modelling in focus and help you to understand it. Then you'll be able to carry on with your workshops in a much better fashion. From 3 to 5 o'clock we have the continuation of the morning session which will focus on the Certificate of Approval process. I remind you once again that dinner is from 6 to 8 o'clock. The Minister is coming, and then we have another session from 8:30 to 10:00 followed by a question period. How long that will last depends on how much stamina we have, I presume.

Finally, I wish to say that the success of this particular workshop depends entirely on you. We have gone to considerable lengths to put the material together, bring the correct people here, set it up and provide the facilities. We really need you now to come through. When we are finished tomorrow afternoon and sum up the Plenary Session, the value of what we see then will depend on how much you have put into this particular process. Thank you all for accepting our invitation and attending and I hope you'll enjoy the next two days. If there are any problems, browbeat some of us; Florence, John Hewings, Murray, Chester or myself. Make sure you get the best out of your facilitators. Make sure your recorders get everything down and when it comes to the Plenary Sessions, don't be afraid to get up and voice your opinions. Before we break for coffee are there any questions? So far so good.

Workshops 1 and 2 will be in this room. I presume they will put the door across so you don't distract each other. The Canadiana room and Don Mills room are just down the hall.

APPROACH TO ASSESSING APPLICATIONS FOR A CERTIFICATE OF APPROVAL

FIRST PLENARY SESSION

Mr. Chester Duncan:

We'll start off with the comments that were put together by working group one. Les Fitz will come up and take over the podium to tell us all about his session.

Mr. Les Fitz:

Thanks very much, Chester. I'm not sure I'll tell you all about the session but I'll try, based on the notes that Joel Kurtz took. If there's a problem with the session, Joel is responsible — not me.

I would like to make a couple of general comments to start out and then we will get into the specific technical comments. It was generally agreed that our group worked very well. There wasn't any serious mudslinging or anything like that. Considering we had a broad range of individuals from various backgrounds, we very quickly got into doing something fairly constructive. Each person in the group appreciated the opportunity to come in and talk about the process, where it might lead and their concerns. They suggested that they sincerely wished to participate further in the process - we'll get into that a little bit more tomorrow, of course - and the consensus was that it was productive. There was an overall satisfaction with the way the process was conducted today.

The technical points that I'll offer are certainly not ones that are the result of the group's unanimous decision or even a consensus. By and large, many of the points raised were not fully resolved but they are significant and need to be considered as we proceed. If we can keep that in mind, I think it will put what I'm going to say in perspective.

The other thing I would like to say is that Chester didn't really give us enough time to reduce our 28 pages of notes to a few salient, specific, points so please bear with me. A few of these points may seem pedantic in the minds of some people. Some of them are fairly obvious, but at the risk of boring you I will go through them and hope that I haven't missed too much of what the group put together today.

I'll break it down to a number of sections: general philosophy, standard setting and certificate of approval. In general philosophy, the group perceived that the Ministry is actually moving towards a combined approach with respect to point of impingement numbers and emission numbers. There is general support for this approach, i.e., the "best of both worlds" approach. The suggestion was raised in the group that we might do computations for emission numbers based on point of impingement, compare those with emission numbers — and I'll get to what they might relate to later — and pick the lowest for Certificate of Approval. The general thrust is that some numbers in the Certificate of Approval is not a bad way to go and is not inconsistent, in some cases, with the kinds of things we are trying to do today.

There's a general thrust that, in some respects, what we are looking at is firming up some of the things we are doing now; putting it into regulations so that it becomes more up front.

Relative to emission numbers, we got into a real problem with definitions and what we mean by BRT/BAT and whatever else you want to throw into that group. A variety of approaches have been suggested which I think are appropriate at this preliminary stage. There is no overall favored approach or suggestion as to where we should go, but there are a number of overlying concerns that need to be expressed. There's a strong desire to avoid the confusing morass of numbers that have been developed in the U.S. There's a need for extreme caution regarding the LAER (lowest achievable emission rate) principle particularly with respect to its socioeconomic impacts.

The next point that I move on to, which is self evident but maybe I need to state it anyway; keep the regulation simple. The method you use in terms of calculations and what-have-you, should be state-of-the-art and well documented so that everybody knows what's happening and follows the same approach. But keep the regulation simple and easily understood. A couple of points came up time and time again within our group, one of them being that clarity is extremely important.

Moving on to the next point, don't enshrine the calculation procedure in the regulation. There was a difference of opinion in our group as to whether it should be in or not. Some were strongly in favor of having the calculation procedure put in and I won't get into the reasons or I'll be here much more than two minutes. There is strong support for not putting it in so that you can maintain a state-of-the-art approach in the modelling techniques. It is very important to retain flexibility in the modelling approach for Certificate of Approvals. Stay with a "may" approach rather than a "must" approach. You may use the equations and what-have-you in Regulation 308 now. The suggestion was that we shouldn't move to a specific single approach that would be a "must" approach, i.e. maintain some flexibility.

There was concern with the more complex models that we might move into, and the wherewithal of putting applications together for approval. Out of that came the suggestion that MOE needs to be very supportive and help the little guy, much more so than we're doing right now. There is a strong concern that the economic considerations in developing emission numbers -- whatever they might turn out to be -- will not be truly played off against environmental impact since, in many cases, we don't know what the true environmental impact is and hence cannot put a true cost figure on it.

The spectre of a long term goal of zero emissions was raised, but we didn't come to any conclusions on that.

It was suggested that things such as long range transport and deposition be considered in the review of Regulation 308 and somehow included in this package review process.

Also self-evident, any new regulation must be easily implemented, easily understood by a learned judge and, most important, must be applied consistently across the province.

There is significant concern with the transitional process if, in fact, we do come out with a new regulation. We should stay with the existing regulation until a new one is factually proclaimed instead of moving towards it and changing our position every time it changes.

One comment was that modelling can be a black box. Not everyone needs to understand it. On the other hand, however, some believe that models can be explained to learned judges. There is a variety of opinion and discussion on that point and I don't think I can really boil it down any better than that.

There was concern regarding how we might look at emission numbers. Would they be developed by plant, industrial sector or contaminant? Would the units be per-production or emission rates? What would the averaging period be, per day, per month, per year? There are a number of similar concerns and it was suggested that we should be pretty cautious in how we approach things like that. We must make sure it is well thought out before we proceed.

The opinion was expressed that modelling is really only a stab in the dark and meaningless in any case.

During the discussion of modelling in trying to arrive at a worst-case scenario, it was suggested that it could be handled by developing a package based on 10, 20 or 30 years of meteorological data in an attempt to scope where you might go on that. Regarding general philosophy, the last point, it was suggested that impact needs to be assessed, not only on a half-hour, one-hour basis, but on a yearly, ten-yearly basis and longer so we can get a true evaluation of a long-term impact on the receptors, whether people or whatever. That about sums up the general philosophy.

Now a few comments on standard setting. If there is one concept that really came through, it would have to be summed up by saying, "we need more openness." We need to release the documentation. The documentation on how we set our standards, what they mean and their impact has to be readily available. This was tied in closely with "those civil servants can't be trusted." You've got to get it out into the public forum.

There was a comment that, in many cases, John Q. Public generally doesn't get involved in public meetings and processes. When they do, they often don't have the technical expertise to handle the data that's being offered. Notwithstanding that, they should, and must, be involved.

We got into Risk Assessment although that discussion tended to wander a little. There was a question of how one determines an acceptable level of risk. There's a suggested need to sort out a log of risk, to put things in perspective on what other risks you are exposed to. There is a position that you really can't get acceptance for any risk. How, as an individual, do you approach a public forum and say, "Hey, this will only kill one in a million?" It goes over like a lead balloon.

The Ministry of the Environment might look at publishing a schedule of events regarding the standard setting process; which ones are being looked at and where we

are in the process on each of those, so that people can react in their particular areas of interest at the appropriate time.

Then we moved on to Certificates of Approval and got into some pretty broad-ranging discussion. There was a wide range of opinion on the Certificate of Approval process. It went all the way from "leave it alone"; "why change it"; "things are pretty dandy the way they are now", to "it has to be changed", "you have to include emission numbers", "there have to be public meetings", "you have to put in housekeeping items", and on and on. I haven't listed all of them, but it's difficult to try and synthesize such a broad range of opinion. I just express it as an opinion of the group for consideration.

Counter to that, there was an opinion that operating parameters should not be included. You might put in emission numbers, but you should not put in such things as "the scrubber will be operated with a 40-inch water drop" or something like that. The suggestions varied as to what kind of emission numbers you might put in, whether operating ranges, maximum ranges or whatever. We touched lightly on fugitive emissions and I'd have to conclude that the group found it very difficult to include fugitive emissions in a Certificate of Approval process. It was well recognized that, in some instances, the fugitive emissions are the most important and somehow have to be included.

There was a strong suggestion that Certificates of Approval need to be handled with public participation, as I have mentioned. There were a variety of opinions on how that might be done. They ranged from "everyone should go through some kind of a public hearing process" to "selected applications should go through a public hearing process." Something counter to the Environmental Assessment Act sort of approach where, "everything is out unless you specifically put it in" to "you might have public input in setting some type of criteria on a plant basis, so the first plant goes through it and everybody else follows suit." The overall conclusion has to be that there was

strong support for some kind of openness and public input in the Certificate of Approval process.

Counter to all of that, there was the opinion that the present system works pretty darn well and raises the question, "do we really need a change in the Certificate of Approval process?"

I hope that's a reasonable boiling down of the 20-odd pages of notes we had. If not, we get into a question and answer period later on. I'll duck out before that.

Mr. Duncan:

Thank you very much Les, it sounds as though you had a very productive day. In order to keep things moving, we'll get going on the second group. Jim Fry, if you don't mind? If there is any real dissention among the groups as to what the facilitators are saying, don't hesitate to speak up.

Mr. Jim Fry:

In going over the notes with Ivan, I was a little surprised that we haven't arrived at more conclusions or recommendations. We had good discussion in the group, but I think we seemed to arrive at more issues and questions, and there were frequently counter views. My first thought was, "well, that's not going to be of too much use to Air Resources," but perhaps it will be in terms of highlighting issues. When a regulation is drafted, perhaps they can be considered in preparing it as this consultation process goes on.

One of the few conclusions or recommendations that was reasonably unanimous was that, of course, the objective to control air pollution, protecting the environment is appropriate. Maximizing containment before considering dispersion is also appropriate. We got into a discussion of BAT and BRT and the general feeling was

that BRT is preferable because it considers the economics of the situation. In many cases, there's a cross-over and BRT and BAT are almost synonymous. Many companies would probably apply BAT on new sources to build in protection against changing requirements. That, of course, is if the cost differential between BAT and BRT wasn't exhorbitant.

There were questions as to how these emission standards would be set and the degree of consultation employed. There was also some question whether the public should be involved. The point was made that now it's difficult —we're kind of hiding, I guess — to compare Ontario and USA approaches with respect to air pollution control, but if you go to emission standards this may be changed to some extent. The feeling was that this may present problems if there are disparities between the two sets of emission standards. The presumption, again, was that this could be rationalized in terms of what each community or jurisdiction assumes is acceptable.

There was a feeling that the move to replace the point of impingement with air quality objectives and wind up with one set of numbers in the regulation seemed appropriate.

It was felt that, regarding public involvement where you're talking air quality standards or objectives (I am using the words interchangeably but I'm really refering to objectives) or you're talking about emission standards, it should be formalized. Everybody knows where they stand and it forces an understood degree of participation, dates and so on. But there were cautionary comments that, of course, if you do this, it introduces delays. This may result in a better product and more public acceptance, but at the expense of doing fewer of these over a given time span.

It was also thought that there should be some means of dealing with the most important objectives first, regarding quantities emitted. There are probably small

quantities of organics, for instance, or other contaminants emitted for which there could be some quick and dirty screening technique. There would also have to be some sort of public health screening. The suggestion was made that the government resources are somewhat limited and could be used more efficiently. For instance, the Ministry of Labour representative suggested that we might ask, "Is this concentration okay?" rather than asking for a documented safe level for each contaminant.

We touched briefly on the genotoxic materials. It was felt that it is tenuous to link human health implications with animal studies and also that you can't ignore compounds which show this potential. There's a need to explain risk assessment adequately and seek public input. Another question arose on how synergisms and air reactions chemistry in the atmosphere were taken into account in standard setting. Again, there were kind of two counter-feelings. If you started to look at this aspect every time you considered a given contaminant you would get bogged down and not get anything done. What if something else of this nature was emitted along with that, what are the consequences? The countervailing view is that you can't ignore this business of synergisms or atmospheric reactions, certainly where they are so reasonably well-known that they should be considered.

There was a question that Chester got hauled into. It was whether or not criteria documents on objectives and standards should be made available to the public. They should be reviewed periodically and, of course, if you're devoting your resources to looking at new standards, the review process is somewhat secondary.

We talked a bit about modelling and again came up with a few questions. In talking about an air-shed concept, what does a new source do? The consensus was to let the marketplace decide. If there's no room, then, that's it, you've got to locate somewhere else. There was another question - should existing sources have a built-in license to carry on with what they're doing and exclude others from moving in?

A further question arose, related to standard setting. What mechanism is in place to review changes to the regulations? Who should be involved? While not a consensus, there was a general feeling that they would like to see a more formalized type of approach.

It was also stated that the models have not been verified. They should be applied to existing sources and compared to our present approach, assuming they provide a reasonable degree of control. From a dispersion point of view it would give you a substantially different answer.

We need some critical evaluation of the science involved. We talked a bit about retro-fitting requirements on existing sources if a new regulation was brought in. The feeling was that this could be extremely costly or prohibitive and perhaps the application to existing sources should be determined in developing emission standards.

Perhaps it could be left to the normal abatement process so that control orders or whatever could be used to upgrade an existing source. The Ministry, for instance, would have to establish the need and, if there was no agreement, the matter would be appealable. There was a feeling that the requirements on modelling should be open to modification as new models are developed. The question of flexibility came up but we could get ourselves into a straightjacket in cases where we have a fair background on a given pollutant. What do you do with new sources, even minor ones? Do you put a halt on development, or how restrictive is the approach?

From a general point of view, there was a feeling that cost benefit analysis of any regulation should be done whether talking emission standards, or air quality objectives. I believe that is in place. It certainly was with the previous administration for any proposed new regulation. A comment was made that there are social

consequences of over-regulating, i.e., plant closings. Of course, there is the counter view that people shouldn't have to trade air quality or health for jobs. You get those counter views when trying to summarize this in short order.

(NOTE: The tape was changed at this point and a small section may have been missed.)

That's my summary of the discussions and I hope the people involved in Session 2 will take the opportunity to emphasize any points they want to, or any I've miss-stated or understated.

Mr. Duncan:

Thank you, Jim. Tom Armstrong.

Mr. Tom Armstrong:

Probably the most important agreement Group Three reached today was that everybody would leave at 5:00 p.m. George and I would stay behind and summarize but, in doing so, nobody would challenge what we'd come up. So we're free George; we can say anything.

We had a very good discussion. Much of the merit and value, as I heard from a number of people within Group Three, came from listening to other peoples' perspectives, not so much in the really pertinent points but the general philosophies and opinions expressed. I think it tells us, Chester, the really preliminary stage we're at in this whole exercise. Many good points have come from Groups One and Two and we tended to digest and condense some down a little bit more. With this you're now in a good position to go forward and at least have a number of points to consider. Like the other two groups, we ended up with more questions and comments than conclusions, a consensus or recommendations. I hope that, in the early stage of the process, it is valuable.

Number one, there was a strong feeling that the current Regulation 308 even though it needs revision has considerable merit. Think long and hard before you really get into changing it too drastically. From a transitional point of view, make sure there is a strong bridge between where we are now and where we're going, even though it needs revision. The second point, and a fairly major one, that we spent a lot of time on in the early stage of the discussion, was that all the emissions have an impact, although some are negligible. Although a relatively simple statement, it is very important in terms of the overall exercise. The corollary is that some contaminants have unacceptable effects and require zero emissions. Again, it's condensed but I think there's a fair bit of meaning there. The ones that have unacceptable effect are broken down into those with a potential impact on human health, i.e. the carcinogens, the persistent biocumulative toxins and those that carry a long distance — the long-range transport aspect. Thirdly, three out of eleven in the group said positive control should be required, regardless of any other conditions, which is also very meaningful. The group had real problems with the BRT concept. Starting with the confusion of "would this necessarily mean any controls", we went round and round this and didn't reach a consensus. In talking to other people afterwards, that was also the predominant view in other groups. Fourthly, from a legal point of view, it would not provide a sound base for enforcement. That was the feeling of the group. The nebulous nature of what is reasonable could be argued and challenged by the learned judges you spoke of, Les. Cost benefit, as we understood it, would certainly come into play and could also present much ambiguity to the overall process. From an approval point of view, something near and dear to my heart, it would present real difficulties. Consistency; as the group addressed this, it was felt that one plant in a given location with a real financial constraint could end up with different requirements from a similar plant in another location with a different financial picture. Consistency would certainly be a major consideration. We also considered existing plants and new plants. How are they treated? Is it retroactive? What are the transitional requirements, etc? Fifthly, the group didn't decide on a desired level of control that should be applied but

the overriding feeling was for getting to a practical level of control in light of the conditions that surround the situation. I realize that's fairly general but there is a message there. One of the group insisted on the use of the best available technology regardless of the conditions and there was a real concern for the application of the proposed models. The group didn't get into much detail of the particular models proposed. However, some of the results of the application were stated very clearly and there was a unanimous feeling in the group, "Let's go carefully in this area". One suggestion was to make the floppy disks available to various people so that if companies could run them they could see what impact it would have on them. I understand they're $5 or $6. That suggestion could put some practicality into what these things mean and the impact on the present sources.

On the question of standard setting we felt strongly that there should be an ongoing review of all standards in light of new information that becomes available. There should be public input, in some way, to this process. Long-range transport should be considered and deposition standards should be looked at very carefully.

That's it, Chester. In a nutshell, I really appreciated working with Group Three. I hope they felt the same way. It was a worthwhile, amicable discussion and there was a good expression of feelings on everybody's part and I think it provided an excellent preliminary stage to your process. Thank you.

Mr. Duncan:

Thank you Tom. (You seem to have had one dissenter all the way through. I won't ask who it is.) Michael do you want to come up.

Mr. Michael Caranci:

Most of the important parts have been covered. When Les Fitz took about twenty minutes to go through his presentation, I was sitting beside one of the fellows

in my group this morning and he said "Geez, I think I was in the wrong group."

We covered all the same areas and came up with a lot of the same concerns. Regardless of how this presentation comes out, believe me, our recorder has all the facts in his briefcase and they'll get reported in due course. We tended to summarize the events in about half a dozen points for the morning and the afternoon. In the morning we talked quite a bit about point of impingement, what it meant and how relevant it was. Surprisingly, we seemed to come to a general consensus on these points. The first was that point of impingement has a place in this regulation as one aspect of the Air Management Program. It's not the total answer, it's one part of it. We shouldn't toss it out. Secondly, best reasonable technology has a place. We tended to centre on best reasonable technology. I'm not sure our definition is the same as the one in the manual. We felt there is a definition of BRT that covers the whole scope and includes best available technology, and best practicable technology. We felt that BRT includes everything from straight dispersion to the best technology you can apply and really depends on other considerations such as land usage and criteria for the compounds you're looking at. So best reasonable technology has a place. With respect to the difference between genotoxic, carcinogenic, persistent compounds — that should be the very best technology that we can find. Once you've applied that, then you look at the dispersion. Regarding the other materials that are more of a nuisance aspect, again our definition of best reasonable technology might apply in certain circumstances, or might be defined as dispersion alone. Some consideration was given to the U.S. approaches — in particular the attainment area approach. Perhaps it can be considered as one part of our Air Management Program.

There is no doubt that the standard setting process should be more open. There was an opinion that there's a difference between policy and the technical aspects and

perhaps the policy side should be pre-determined by the politicians, the technical side open to public process. There is a place for zero limits but strictly as a goal that we recognize we won't achieve, but will strive to attain through the application of the best technology we can find. With respect to the afternoon session and the Certificate of Approval process, there was some concern over using the worst case approach as far as modelling is concerned. There needs to be some balance, a number of exceedences that are acceptable, but surely the worst case should not apply. Again, best reasonable technology should be applied before we do the modelling. That's a two-step approach. We got a little bit into how we deal with maintenance and operation of facilities once they're constructed. There was an attitude that our Certificate of Approval should be stated as an approval for construction and operation of a facility. We should stress that. It shouldn't just be for construction. There was also a general feeling that the legislation we have now is probably all we need to deal with this aspect. We can put conditions on Certificates of Approval now. Let's do it! There was a general agreement that those conditions might include process monitoring, compliance testing, compliance reporting and so on, but the process is there now if we want to use it. With respect to these conditions on Certificates of Approval the process should be opened with respect to the applicant. The applicant has to have an opportunity for some input into those conditions to ensure they are realistic.

Lastly, the Certificate of Approval process must be open to the public. It was suggested that this process be similar to the one we have now for water and waste, where hearings are optional and the director has the ability to require a hearing for major facilities. There was complete agreement that for minor facilities, things which are not going to impact too much on the public, it will be a waste of time. For major installations, provision should be made to have a public hearing, but it should be optional. That's it. Thank you.

Mr. Duncan:

Thank you Mike. I would say, from the four reports we've had this evening, that there has been a lot of discussion. Some has been controversial and we even had some consensus which I really didn't expect we would reach with the way we had set this workshop up. I know the evening is getting late so I'd like to open the floor to any questions and I hope, between the facilitators and our resource persons, we can answer most of them. Are there any questions?

Everybody agrees with what their facilitator says. Oh, I'm sorry Dick, go ahead.

Mr. Richard Walli: (Walli Engineering Inc., Independent Consultant)

Somebody just said I wasn't being paid for this but I still want to make a comment. BAT/BRT — maybe we should add one word to those two terms and instead of just saying best available technology, etc., we should say demonstrated technology. It's another word but I think that it's important that we add that to the BAT/BRT.

Mr. Duncan:

Yes, that's a good point, Dick. It sounds like it came out of the steel industry. Nigel?

Mr. Nigel Guilford: (Tricil Ltd.)

Mike summarized pretty well what we discussed but lest anyone go away with the impression that a group consisting of Hydro, Inco, Abitibi, Tricil, etc., endorsed the idea of zero emission in any respect, let me clarify that that was a minority opinion — a small minority opinion.

Mr. Duncan:

How many industrial people in the group? 14 or 15 in the group and you had four? Ken.

Mr. Ken Smith: (recorder for group 4.)

I think Mr. Kempling had something he wanted read into the record for this evening so I'm just doing that for him now. I'll quote it directly from what he's written here. "I believe that the recommendations given on the bottom of page 2 of Final Report, Air Resources Branch, work group three and the definition of best reasonable technology given on the top of page 3 are acceptable as a philosophy for Air Pollution Control and will be workable for the petroleum refining industry. Signed Chris Kempling."

Mr. Duncan:

As a representative of?

Mr. Smith:

Esso.

Mr. Duncan:

Mr. Hogg? Do you want to make a comment on that as the PACE member.

Mr. W. Hogg: (Petroleum Association for Conservation of the Canadian Environment - PACE)

I would agree with it, Chester. We've always required best practical technology rather than best available and I think the word "demonstrated" is a very good addition.

Mr. Duncan:

I do too. Yes Rob.

Mr. Robert Butler: (Inco Ltd.)

I'd like to make a comment about the models. I have had some experience with these models because we at Inco are using them for supplementary control on a daily

basis. Today I went to the computer that was set up at the back of the room and did a calculation for our stack and compared it to what the previous regulation would have given us and I found a factor of five. This new regulation is five times more severe.

I would suggest that, if you look at the models and compare them, you would not expect as dramatic a difference as that. I mean you compare the Venkatram model with some of the other models and in particular meterological conditions, they're not that different. The reason why the new models are five times more severe, at least in one case, and I'm sure they'll be much more severe in a lot of cases, is that, they are doing a much more thorough job of identifying worst cases. What can happen is, you may end up in a situation where, if you use that one value calculated for the worst case all year, you're going to have the whole plant shut down to a summertime level all winter long when it doesn't really matter. I think the Ministry should do a fairly thorough comparison of the old models and the new models so that we can see the implication of what they're going to do. Let me clarify. I'm not trying to defend Inco's tonnages, I'm trying to get a common understanding of what these models mean. These models, as they are implemented on that particular computer, are very much more severe than the previous models. One possibility is to use them like we do, in a supplementary way. You don't introduce that most severe condition unless you have it.

Mr. Duncan:

Good. Thank you Robert. Lou, do you want to make any comments or have you made a commitment yet to review it in that light?

Mr. Lou Shenfeld: (Manager, Air Quality and Meteorology Section, ARB)

We did have a working group that was going to deal with the acid rain problem and that group decided on best reasonable control technology, reasonable control or demonstrated reasonable control technology before you allow emissions to the

atmosphere. This would actually limit the emissions to meet what we want in the control of acid rain. Of course, this is exactly what it's doing to Inco. It's reducing their allowable emissions by a factor of five, and probably, that's where they're going to go anyway.

Mr. Duncan:

Good! Are there any more questions?

Mr. Shenfeld:

The comparison is true. Actually we are looking at some more stringent weather conditions which would require more stringent controls. The frequency of the occurrence of high concentrations will have to be taken into account in using just the worst case. We're certainly going to take a look at how frequently that worst case occurs, whether or not supplementary control can actually achieve what we want on the basis of controlling when the condition exists. We have not thrown out supplementary control as they have in the United States but we are using supplementary control for many of the sources and that's still a possibility when the more stringent weather conditions that produce higher concentrations occur. So, in the case of Inco, it is not a good example because we are treating Inco differently in view of the high emissions of SO_2. For small sources we're going to have to take a look at the frequency that the concentrations are exceeding the criteria or objective.

Mr. Duncan:

Yes Boris.

Mr. Boris Weisman: (Meteorological and Environmental Planning Consultants Ltd.)

I agree with Rob's assessment and I think it goes doubly for the smaller sources than Inco. I'd also like to comment on the process we're going through today and probably tomorrow. It seems to me that the approach to the new regulation is a very

major shift in the way industry is going to be regulated in the area of air emissions. I find it surprising that there isn't some kind of advocacy document developed before this kind of meeting which states very clearly what the implications of this major shift are. The feeling I got in our group is that most people still don't realize how major these shifts are going to be if the regulation is adopted as it is. I don't think a two-day workshop is enough to really sort out all of these implications unless they're put down in front of you to discuss in the workshop meetings.

Mr. Duncan:

I hope these two days will indicate to you the difficulty that those of us who are civil servants have in putting together a regulation. Bruce?

Mr. Bruce Caswell: (Petrosar Inc.)

Boris has just expressed some of the same concerns that I was going to raise. The way Lou answered the last question was not satisfactory to me in that what's being proposed, in my very limited understanding of it, is a pyramiding of worst cases on worst cases on worst cases and that becomes your limiting factor for year-round application which is what was being said over here. I think we have to decide whether we're dealing with worst cases or most probable cases and if you're looking at a worst case scenario piled on top of a worst case scenario, then you're really changing the basis for the original number that's set in the first place. Those two have to go hand in hand and I echo what Boris has said; let's really understand what the implication of the change really is.

Mr. Walli:

During the day I had various ideas, thoughts as I've listened to what people have been saying and I've heard people zeroing-in on various toxicants like PCBs, etc. The trouble I've seen is that they have been doing just that, zeroing-in on very significant industries. What we are trying to do, as I thought, is to look at all of industry for

Ontario. We're looking at the little spray booth, iron casting, the mini-mill and on up there through the Stelcos, Dofascos and Incos. We're looking at an overall thing and when I hear our people get concerned about specific industries, I don't think that's what we are addressing today. Are we? Or are we looking at the overall picture?

Mr. Duncan:

The overall picture from your point-of-view, not ours.

Mr. Walli:

Yes, the overall picture and that's what I think we should be looking at. People have been getting off on specifics: the PCB problem, . . .

Mr. Duncan:

We'll have to talk to our facilitators to keep it on track.

Mr. Walli:

I think we should all start looking at the overall, the little guys as well as the big guys; the philosophy of what we're doing.

Mr. Duncan:

I appreciate that comment. Mr. Drowley beat you to it, Ron.

Mr. Brad Drowley: (MacLaren Plansearch Inc.)

Mr. Chairman, I've enjoyed this session and I'll tell you why. I think it has pointed out the problems that exist for industry, the public and the regulator. There's no doubt about it, they're pretty complex. I don't think we're going to resolve them tonight but the fact that the Ministry has arranged this session to hear what the problems are and to get some input, bodes very well for the future. I'm not going to

say we will leave here tomorrow afternoon and I'll be happy. As I understand it you want some input and the gestation period is going to be slightly shorter than an elephant's, something like nine months, which is normal. That's what you told me today. This bodes very well and I understand that the opinions you get in this session will be massaged and manipulated and put into some kind of draft document which will then be circulated and we can all have another kick at the cat. On that basis we've had a very, very good discussion. I don't think tonight is the time to get into details about whether one model is five times more stringent than the others. The point has been made on that side, but I think the concerns are being expressed. Knowing you, Chester, you will take these into account and I would like to move a motion that on this note we adjourn, Mr. Chairman.

Mr. Duncan:

Thank you Mr. Drowley, but that is not before the floor. I have Mr. Denning waiting to make a comment. Please give him that.

Mr. Ron Denning: (Lambton Industrial Society)

I would just like to make a brief comment, something that came out in our workshop. We heard several times about the public's lack of confidence in the Ministry of the Environment and one of the factors commented on was that Regulation 308 has done a pretty good job in its existing form. Some enormous improvements have been made possible under that particular regulation and perhaps some of the lack of confidence is due to the ministry's non-desire to blow its own whistle once in while, or trumpet on things that the public do not understand, like when testing is carried out. As soon as the results are available, the companies involved are notified, maybe one or two years ahead of the issuing of the formal report, so that actual abatement can start at that point rather than waiting for formalities. This is something that, if the public doesn't understand it, the Ministry could actually take some examples from history and

demonstrate that there are good parts to 308 and the abatement process is, in fact, the best way of obtaining immediate results rather than waiting for major changes in legislation.

Mr. Duncan:

Thank you Ron.

Mr. Walli:

May I comment on that? I've travelled a lot throughout North America and the world and the Ontario Air Pollution Control Program has been held up as a model everywhere. I wondered, when I was invited here, why? What are we trying to do? We have done such a good job in Ontario and I don't think we have to be ashamed of what we've done.

Mr. Duncan:

Oh, I don't think we're ashamed at all.

Mr. Walli:

It's super and I guess we can make some improvements, but we have done a good job in Ontario and I think the Ministry should be applauded for that.

Mr. Duncan:

Thank you. Dr. Balsillie, have you a question or are you going to dethrone me?

Dr. Balsillie:

I'm here to second the adjournment and thank everyone for their input today. I said at lunch time that we shouldn't be too concerned if this morning we felt a little disoriented and as if we were going in various directions. We heard four presentations

from the facilitators here tonight and I don't think they sat at the same table during dinner and yet there seems to be some consensus. There seems to be some very strong and clear messages to those of us who are charged with trying to put together a revised or new regulation. We're starting to hear those messages and I congratulate those who have spent the day belabouring some of these points and discussing them in depth. Things are starting to move. I've heard only good comments about the process and the unstructured nature of it. We stepped off the edge when we decided on having an unstructured meeting and I challenged you this morning. You've risen to that challenge and we appreciate it. Having said that, I'd like to second Mr. Drowley's motion and close the meeting. Murray, I understand tomorrow morning there will be coffee and danish at 8 o'clock as well. So for those of you who get stuck on the parkway . . .

Mr. Duncan:

We will meet again tomorrow with new groups and please bring your tent card so that the new facilitators and new recorders will know who you are. You will be in new rooms and as David has offered, you can have your danish and coffee at 8 a.m. We will start at 8:30 a.m. Have a good evening and thank you for your participation today.

Friday, November 15

SECOND PLENARY SESSION

We're going to let you start, Barney. Would you please review what your group did?

Mr. Singh

We started out by looking at the material presented by Phytotoxicology Section and the phyto numbers. One of the recommendations was that it should contain other materials such as organics and we were told that as the Branch collects this information, it will be added. It's a statistical package requiring at least thirty numbers which will have to be spread out so that they're representative. One suggestion was to call them "range of observed values" because we felt that people will take those numbers and regard them as an upper limit for contamination on properties. Even though there is adequate description on the first page, there was concern that people will not read that page and will react to the number in a manner that will ask for action to be taken because of their perception that there is pollution. Another suggestion was that perhaps there should be an extra column in which levels where there is a concern for health would be expressed and that, perhaps, will relieve some of the concern that was mentioned earlier. In using those numbers there is a great need to develop an understanding of what the information is. We see that as a very formidable task.

We then moved into the subject of what to do next. What's the next step after this workshop? It was felt that the Ministry should keep the reports from this workshop and develop a broad direction in which we want to go using the material from the workshop to generate the rationale for a change of direction if that is what is recommended. We should also talk about the implications of change so that this will

be readily understood and the material should be widely circulated. We should then seek input from concerned groups and allow a period for comment so that the thing isn't drawn out too long. That should result in a revised draft regulation and we should then look at any necessary amendments to make sure that this new proposed regulation will conform to the act. We should again seek input to the draft, allow for a period of comment and eventually arrive at a final revised regulation. We didn't think we could specify time periods for each of these activities to take place because the job is so important that one needs to take whatever time is necessary to have the job done properly. One of the questions we were asked was "How do you get the concerned citizens to input into the system?" It was felt that this may be achieved by having public information sessions where the Ministry is willing to go out and explain what it has proposed, give its rationale and create an understanding among groups.

It was also decided that, on the circulation of the draft revised material, perhaps there should be public notice of its availability. We should send it to workshop participants, other interested parties, trade associations, industrial associations, public interest groups and solicit other options for getting comments, maybe written comments. I mentioned public meetings and public hearings. The group didn't think very much of public hearings but we thought that should be a stated option.

When the final regulation comes out, there should be some mechanism for future revisions. There is a caution that one should not formalize this in great detail otherwise you may find yourself having to follow a formal process to make minor changes. We're recognizing further input to the system but, at the same time, not to make it so difficult that you have to follow a very complicated process to achieve minor changes. We should also cover a phase-in period for the new regulation and whether there is going to be grandfathering of existing situations so that people who

may not be able to readily comply will have some time to adjust to the situation. However, if you're not going to follow a complicated procedure, as a minimum there should be a public notice before any intended changes are made so that people governed by our regulations are aware of what is intended.

We then moved on to other topics and we dealt with definitions. The group did not have any comment to make on definitions at this stage but they should be reconsidered when the regulation is being revised to ensure that the definitions are meaningful. As an example, last evening we came up with a new term: Demonstrated Best Reasonable Technology.

We moved on to the API and had an explanation of its legal status and its use as a control tool and bought the proposal that it stays as it is. However, there should be some consideration to see if it could be adjusted to include other parameters since the AQI is now considering other parameters. It was felt that ozone should not be one of the parameters considered if there is to be an adjustment of the API. The AQI, as an information tool, tells one about the quality of the air. In fact, it may tell you that the air is lousy and we see a problem with having two indices, an Air Pollution Index and an Air Quality Index. However, we hope we can overcome some of those problems. For instance, if the weather is lousy, we don't blame the weatherman for causing it and if the Air Quality Index is lousy, perhaps we can somehow deflect blame from the Ministry.

We thought we could get away with it because it's based on ozone and we have little contol over the incoming ozone to the system. However, we'll have to live through that period of explaining these two numbers.

On opacity, we agreed with the recommendation to have certified trained observers.

Regarding incineration, we were told that steps are being taken to have a state-of-the-art paper prepared and that the Ministry guidelines are being revised. We support the revision of the guidelines and we felt this forum has been a good place for circulation and discussion and hope that when those draft guidelines are prepared there will be an opportunity for input from diverse groups. Incineration is a growing activity of some importance, especially when you look at waste management and the future development of energy from waste.

In discussing open burning there was a question concerning the burning of railway ties that had been treated with chemicals. They have been a problem in the past. I believe the Ministry has managed to control that with the railways concerned. However, we supported the status quo and didn't feel anything needed to be changed and encourage municipal by-laws to deal with nuisances from neighbours.

If any members of the group would like to add or correct anything I've said, please feel free to do so.

Mr. Duncan:

I guess they all agree with you, Barney. Thank you. Michael, would you like to go through your group report please.

Mr. M. Caranci:

I would like to preface my comments with the fact that what I'm going to mention are what I consider the highlights of the session and the most significant points. Between the recorder and myself, we got down most of the comments the group made and most of the areas where there was some conflict or disagreement. It is certainly not a presentation of everything that was stated this morning. The items aren't necessarily ones for which there was a consensus. They are simply what I consider to be the highlights.

A general comment with respect to the process was that there was almost unanimous agreement that the workshop has been an excellent format, with the one provision that, were we to do it again, we should provide more background materials in plenty of time. There was some criticism that materials weren't provided in time for people to thoroughly review them. There was also concern that some of the written materials and verbal statements imply that in some of the things we're talking about decisions have already been made. Some constraints weren't brought out well enough. I'd like to comment on each of the areas we dealt with in turn. A lot of the comments will be similar to Barney's.

First, AQI versus the present API; there was major concern that we're going to end up causing total confusion with this process. It was suggested that we stay with one type of index — an Air Pollution Index or whatever you want to call it - and that we not announce qualifiers every time we say the index is 25 or 32. There was a strong feeling that if we start introducing new chemical names to the public it will cause confusion. People won't know what it means.

On the question of opacity, there was no objection to using it as a control technique. There was agreement that there should be training of the people who estimate opacity. It should be done twice a year as in the United States, instead of once a year or once every two years as we do now. We should also provide clarification or some way of dealing with the issue of steam and how it affects measurement of opacity in plumes. The group felt that the section does not define what compliance is. It simply says you can't exceed 20% opacity at any time and that wasn't thought realistic. We should have some definition in there of how you determine compliance. Do you take three observations over one-minute periods or over a half-a-minute period? There was no suggestion as to criteria but it should be defined in some way. There was also a question, again, that we consider the possibility

of controlling the colour of plumes differently. In other words, maybe we deal with coloured plumes separately from white plumes and thereby solve this steam aspect in some way.

Section 9 is the one that says people must report upset conditions. There is some provision for the Ministry to approve operation under those conditions and it was made clear that that section is not considered valid at the moment. We do not have the authority to approve operation that will result in the violation of the legislation but there was a consensus that we should have that authority. MOE staff should have discretion to approve or accept operations that will cause exceedences due to breakdowns, start-up conditions and so on. We should have some discretion in that area —some legal discretion.

On the topic of incineration, there was a question that I simply couldn't answer. In the section that states you can only emit 100 ppm, it doesn't say hydrocarbons. I forget the exact wording, but there was some question on whether that was total hydrocarbons, particulate and gaseous, or only gaseous or only particulate. The general feeling was that it should be defined, either in the regulation or as a matter of policy. Section 10 of the regulation dealing with restricting combustion in equipment to the materials that it was designed for, could say, "designed for or approved for".

On the question of open burning, there was not much response, mainly because there was not a real appreciation for the problems that exist with open burning and it was hard to solicit opinions. There was some concern due to personal experiences with open burning and a suggestion, as in Barney's group, that this be handed to the municipalities, either through a permanent program or by-law, or something. On phytotoxicology, the guideline is a useful tool but there were a number of problems with the presentation of it. For example, in the write-up it states that levels

exceeding the values on the table are an indication of pollution. We all agreed that that was not true. It may be the result of pollution. There was some concern with the wording. It should be described and explained in a much better way than it is now and the mathematics of the numbers should be reviewed so the data is statistically valid.

The last item was how we should proceed. It pretty well parallels with what Barney was talking about. First of all, to repeat, there was consensus that this format has been excellent with the exception of providing sufficient materials ahead of time. All materials provided should be a matter of public record and that includes all future materials. We should continue regular notification to all the participants here and maybe some who aren't here. We should have a mailing list that we would use to notify people of the status of the steps we're taking. Most important, there should be a complete report on this workshop as there are likely to be different opinions and conclusions from the different working groups. We all only attended one at a time. There should be a tentative time given for the presentation of that report. Perhaps in parallel with that, or to follow it shortly afterwards, we should prepare a discussion document which indicates the state of the process and what constraints there are on revisions to the regulation. We heard this morning there are some legal constraints and those should be spelled out in a discussion document. There should be some sort of proposed timetable in the document. There was a general feeling that this could go on forever and there must be some finite limit. The discussion document should include all the anticipated impacts of the various options that might be considered in the new regulation. If we were to change the modelling technique, what is the impact economically, control-wise and, of course, financially. The discussion document and the summary of this conference should have a definite time for response attached to it: 60 days, 90 days. We should look for written replies. As I said earlier, all of the individual replies should form part of the public record so that each person here or any member of the public could come into an MOE office and see what everybody's

position was. The next steps in the process I don't think were clearly defined but we agreed that, following the stage of written responses, we have either a similar workshop to this or proceed with a draft regulation, distribute it and then have another workshop. There was no doubt that the group would like to see some separate seminars organized on the major technical items, the main one being the modelling. There was a strong agreement that it's significant and complicated enough to warrant a separate workshop with people attending who really know what modelling is all about. So I think our group would like to see those scheduled.

Just a couple more items and I'll get off here. The first is that the revised new regulation should include a provision to require a regular review of the regulation. Apparently, this is done in the U.S. where you have a clause in the regulation which says it must be reviewed in five years, three years or whatever. Second, and similar to Barney's comment, the new regulation or draft regulation, if it is to have a major impact, must contain some consideration for a phase-in period, grandfathering, that type of thing. That's all I have to say.

Mr. L. Fitz:

Much has already been said about the value of the workshops and the need for further workshops. I don't think our group came to any overall conclusion but there is certainly a lot that would support the general comments that Mike made earlier. On the specific technical points, we didn't cover all of the issues. I'm glad to see some of the other groups did. There was one important issue raised, namely the concept of destruction-removal efficiency and the options of having it embodied in Regulation 308, in a separate regulation, left out, or considered as part of best reasonable treatment technology. It was raised as another means or another measure of control for incineration. There was no conclusion reached within the group except that it's certainly worthy of further consideration as we proceed with the review and development of the new Regulation 308.

We spent much of our time dealing with the AQI. Some people knew a reasonable amount about it. Some people knew very little, but there was certainly a lengthy discussion on what it's all about and where we might be going on it. There was a consensus -- maybe it was unanimous --that we use the AQI as an information tool only. There was also consensus that we keep the API as a regulatory tool. It was considered extremely important that we lay on a very comprehensive public information program prior to the introduction of the AQI so that people know what it's about and can react to it appropriately. In terms of the actual release of numbers down the road on the AQI, the comment was also made that these numbers have to be well interpreted, relative to sources so that the people can clearly understand who is causing their poor air quality or whatever. There's a suggestion that the AQI should be studied for potential use in a regulatory concept as we gain a little more experience with it. This is somewhat analogous to the comment that Barney made earlier.

Another suggestion endorsed by almost everybody in our group was that we consider establishing rural AQI stations, particularly in areas such as Simcoe and the forested areas in Northwestern Ontario, to bring the rural air quality picture into perspective, to provide information on long-range transport and deal with things like ozone relative to Windsor levels and rural levels.

We got into an interesting discussion on opacity. The group generally agreed that it was important to look at the implications of how we approach opacity as we review Regulation 308, particularly with respect to such things as batch operations and non-steady state operations.

There was a consensus within our group that opacity training as currently conducted within the Ministry be made available to the public at large. Finally we got down to process and how we approach it from here on in. Chester, at the outset, had

suggested we keep 45 minutes aside for that. We did, and it certainly wasn't enough. I suspect we could have gone on all afternoon.

It was suggested that a standing committee for continuing liaison be developed including both government and non-government people. The yellow book that was circulated preparatory to this session could also be made available to the public at large. The proceedings based on the discussions and the points noted at this workshop session should be published and made available to the public following some review by the participants of the workshops. We didn't come to grips with how that might be done — just the suggestion. This might be followed by the Ministry developing a green paper, a document that would include the draft regulation with the significant background documentation as well. It would also be made available to the public. Concurrent with that, notification in the Ontario Gazette was suggested so that everybody would be aware of where we stand on it. It was about then that we ran out of time within our group in proceeding further in terms of a specific agenda as to how we might proceed. We took the old civil servant route to follow up with the rest of the discussion and direct comments to Chester. However, I think there is some suggestion within the committee that, considering the nebulous process we might need to go through in dealing with the deep technical issues in Regulation 308, it may not be appropriate to try and cast an approach in stone at this time either.

That, in essence, is what our notes suggest we got out of our group this morning. We certainly wandered about a bit and in the question/answer period, don't hesitate to bring anything up that I may have misconstrued. Thank you.

Mr. Duncan:

Thank you Les. Jim?

Mr. J. Fry:

Thanks Chester. We left the process to the end and I think we spent all of five minutes on it so I hope we didn't short-change it because it's obviously a key item. A number of our comments in the group were somewhat repetitive but they are probably worth mentioning to give the overall proper emphasis to particular points.

We started with definitions and were a little ambivalent on the subject of the fuel burning definition — not a big deal — but there was some feeling that it should, perhaps, be retained. It's in the Act, I believe, in Section 8. It's in Section 10 of the regulation and perhaps a definition should be there unless there's a generally understood dictionary definition. We then took a side step and started talking about wood stoves and the question arose as to how they can be legally regulated. Perhaps there should be some certification system with respect to design. There certainly are local problems associated with them. Whether there are any community problems, it was felt that this should be documented somewhat better than it is right now. There was the feeling that it could be an important item because it obviously provides background and if it's an unregulated source it's going to require extra attention on other sources, is that an appropriate way to manage the air?

There was a comment that item two is redundant in that this regulation applies everywhere in Ontario.

We got onto Section 3 and I believe the working group had made some comment in their recommendations that visible light should not be dealt with under approval section. There was a concern as to whether it should be dealt with in the Environmental Protection Act at all. It's a facet of radiation but it was not a major item. We talked about Section 3 which has to do with exemptions to approval and then we got onto Section 8 of the Act regarding Certificates of Approvals.

One opinion was that the Act should require someone, retroactively, to apply for a Certificate of Approval and receive one with appropriate conditions. That might be an easier way to assess the source than trying to obtain information and proceed with the control order or prosecute for not having a Certificate of Approval. These are procedural things and don't bear directly on the regulation. Again, there was a feeling that no-one can construct a facility without a Certificate of Approval - it's Section 8 of the Act - and that seems very dogmatic. You can't stick a shovel in the ground and yet, in practice, that's not being followed and probably isn't practical to do for major projects. Perhaps we should be looking at a two-stage Certificate of Approval process with a construct and an operational aspect to it. Again, that's the Act rather than the regulation itself. On Section 4 concerning the API there was very little comment. There was a concurrence that the API had been successful and very few comments regarding changes to it. We also talked about the AQI. We felt it was good in principle to provide air quality information and try to put in perspective where it's coming from. There's a concern regarding public perception and a need for a rather major education and PR program. There was another comment that the public perception regarding the API and problems associated with it is to some extent, due to weather anomalies as well as sources. The AQI should not change this perception.

Questions arose regarding the number of stations in the community and how well their locations have been thought out. It was felt this could be a source of problems.

There was also the concern that, regardless of how much information you provide, why flag situations that are not controllable, long-range transport for example.

With respect to the opacity, Sections 7 and 8, there were really no comments on the approach of trained observers versus the charts. There was some feeling that it's

an outdated method of measuring emissions. It doesn't relate to mass emission or any property effect that you can readily attribute to one particular incident. There was an overall feeling that it should be retained, but that the requirement should be a little more realistic. Section 8(2) should not just apply to solid fuel but should apply to other processes as well. The prohibition regarding 100% opacity is probably not practical and one suggestion, not well thought out in terms of all its implications, was to have some time limit for 100% opacity as well. We would like to see a time-weighted average with respect to opacity, then it should be larger than the four-minute restriction.

We talked a bit about open burning and, again, there was not a good feeling of the significance of open burning, except when you start to burn garbage or something of that nature, when obviously you can get all kinds of goodies. MOE's approach to private versus municipal landfills was perceived as somewhat different. Open burning shouldn't be allowed at landfill sites. It's okay for fire training provided it's not a waste disposal exercise. Generally, in section 9, there was agreement that it should be retained. There was some discussion whether planned shut-downs can be dealt with under 9b and it was felt that there should be some discretion to deal with them if it makes sense in the context of properly operating the system. There's a possibility, of course, of dealing with the planned maintenance, the frequency and the implications at the Certificate of Approval stage in terms of operating conditions which could, perhaps, be built in.

In section 10, regarding switching fuels and so on - burning fuels in a system that's not designed for it - there was concern that the change in fuels would require Certificates of Approval but the consensus was that, at the initial Certificates of Approval stage, the whole range of fuels and the implications should be dealt with. There may be changes that can be dealt with under 9b.

There was some concern about the words "every step necessary", in Section 11, which stood out. Perhaps there should be some modification in terms of what's reasonable. It seemed a somewhat subjective area as well, unless there were guidelines available for guiding the Ministry inspector and the source operator.

Section 12 has to do with a 100 ppm hydrocarbon as methane emission limitation from incinerators and there was a general question as to whether it applied to all incinerators, including institutional, pathological and so on and whether the hydrocarbons may or may not be caught in the multi-chamber. Then we got side-tracked on whether apartment incinerators meet the 100 ppm level and if there is any program to determine if they meet it. Incinerator down-wash could be subjecting people to all kinds of goodies. They could also be contributing to overall background air pollution in a disproportionate amount. In other words they're not pulling their load and it has implications as far as the municipalities are concerned. If it's not burned there, it will have to be taken away to a waste site. That shortens the life of the site. Because of that, there's a back-up all the way. There is also a different MOE stance on that compared with other facilities where there isn't that type of thing.

We thought that Section 13 seemed very prohibitive. For example, you're not supposed to discharge a contaminant; in other words, if you're filling something you're venting it, which is automatically contravening this section. The question was, could it be deleted and covered under the general provisions of Section 6 regarding discomfort, property damage or whatever, or at least modified to make it a little more practical? A lot of the comments on the process were similar to Mike's. The group would like to see proceedings provided. We envisage the Air Resources Branch taking the comments that have been made and proceeding to a draft. From there we talked about whether there would be local meetings, whether the same group should be brought back, or whether we should have a wider distribution of material. We need a

clearer idea of the implications of changes proposed vis-a-vis what we have now. This could be done partly by the Branch and, if these models or some variation of them are proceeded with, then perhaps the programs could be made available, with some documentation, so people could use them and get some feeling for the difference, recognizing there are some bugs in the program that have to be resolved. Those were basically our comments.

Mr. Duncan:

Thank you Jim. I would like to make one small comment. When you got on to wood stoves, we actually are doing some work. We have a contract with Ryerson to do evaluation of fireplace inserts at the moment, so we are looking at it.

I'd like to open the floor now for questions. Michael, would you please identify yourself at the mike? Thank you.

Mr. Michael Perley: (Canadian Coalition on Acid Rain)

A few points of clarification. I'm not entirely sure at this point what form the report of this exercise is going to take so I would like to make one suggestion to help us all when we review the report. When you discuss certain sections of the regulation, would it be possible to indicate what section of the EPA they refer to, or if there is some relationship between a given section of the regulation and a section of the EPA for clarification? For the same reason, because I guess a decision hasn't been made as to what final form the report from this workshop will take, would you make available transcripts of the facilitators' notes and their summaries for anybody who wants them? I realize there could be a fair amount of material, so could you make those available for those requesting them? A couple of more substantial points: if you're going to do an economic impact analysis of best reasonable, best available, or whatever type of control technology you select and include that in the report or at some later stage of

the proceedings, would you also do an economic impact analysis of the effects on the environment of the use of any given technology? I'm thinking particularly of things like comparisons of the effects on public health and/or other parts of the ecosystem of the use of a best available versus a best reasonable technology so we have some sense of the costs to industry of the use of a technology as well as to the environment. Finally, I'm not sure exactly by what process you draft a regulation either in draft or final form and I'd like to suggest that non-government observers be included in writing a draft and a final regulation.

Mr. Duncan:

Thank you, Michael. Are there any other questions? Syd.

Dr. Syd Barton: (Ontario Research Foundation)

This is more of a suggestion than a question. I'd like to endorse the idea of a technical workshop on modelling proposed by Work Group three but my personal feeling is that there are other subject areas that need equal or greater attention. I sense that the amount of effort needed in defining best reasonable technologies for the various sectors and the associated emission standards that will go with them has been underestimated. That would certainly be worthy of a technical workshop. Another subject needing attention is the application of risk assessment in management techniques. Thank you.

Mr. Duncan:

Thank you Syd. Are there any other questions? Yes sir.

Mr. J. Kempling: (Esso Petroleum Canada, and PACE)

I work for Esso and I'm here officially representing PACE. First I have a statement and then a question to the MOE. I can start out by saying I'm from Sarnia

Industry and it's easy to be a bit paranoid at this point whenever anybody says they want to talk to you about an environmental matter. So when we received the invitation to a workshop, there was some feeling by the people in the industry that perhaps, just perhaps, we were being set up through some sort of a PR activity. I'm happy to say that when I go back to report to people I can tell them I strongly believe that was not the intent of this workshop and was not the way it was run. I'll also tell them I've been very pleased with the people from the MOE that I've been able to work with. They've been a highly professional group of people. They've run an excellent workshop here and done what I consider to be just the right thing at this time. I'll also be saying that I believe that, through a continuance of the process, descriptions that you've heard here and our suggestions, we can come up with some really sound revised regulations for control of air pollution.

I said I had a question. I have my own vision of where we're going, based on the workshop, and after I tell you it I'd like the MOE to tell me that I'm generally correct or somehow way off base. Suppose we develop a regulation that has some definition or philosophy such as best reasonable technology that includes a statement that we expect all industries to use something of this sort. It's my vision that, after the regulation comes out, the Ministry would get together with individual industries, with the public and other interested parties to actually define what best reasonable technology, or whatever it is that we decide on, means for that industry. So my question is, is that correct? Have I got the right impression that first, we'll define it philosophically subsequent to the regulation being put out, then we will define what it means with each industry?

Mr Duncan:

That's an interesting question, Chris. I don't think we have gone that far. We're looking at a process starting essentially from here and we will work our way towards

that. There will be a lot of input before that regulation is finalized. It won't be just drawn up and I think we've tried to stress that. We want a lot of input. This is a new process for us and that's why we're asking for your opinion as to how you think we should go. I attended a legal seminar a year ago on where we should be going in regulations, and C.E.L.A. at that time outlined a process. I've looked at that and it has a lot of public input and is covered fairly well by all the groups. It is a step-by-step process; slowly with input from a lot of people. That's the way I, at least, intend to go. I hope that answers your question. David do you want to add to that?

Dr. Balsillie:

We've had some pretty loud and clear messages here over the past couple of days and I've made several notes. We've got all of it on tape, so we'll be reviewing it. There's been a lot of comment about the process. There's been a request for a discussion document or a green paper, or something along that line. There's been a request for further technical workshops on things such as modelling. There have been requests for more concise, precise information on the implications of what we're looking forward to doing and all of these things will have to be done. We've heard that, so we'll be distilling what we've heard from you today, putting it into a process and getting it back to you and saying: "this is what we propose to do" and then we'll go ahead with it. We've heard very clearly from you over the past two days and I think we're going to take it and run with it.

I don't think we've addressed your question about best reasonable technology and when we will come to the industry because we really haven't finally decided to include it. We heard a lot last night and, unfortunately, Chris, you weren't able to stay. There was some comment about whether we might be throwing out the baby with the bath water. Point of impingement may not be such a bad deal. Then there was the whole question of demonstrated BRT and BAT. There are a number of things we have to go

back and distill before we decide what we're going to do, but I think we'll put it all into the proceedings and then look at the implications of each.

Mr. Denning:

With respect to the AQI, the recommendations from your working groups were that the AQI be left outside Regulation 308. Can I ask you how you intend to proceed now on AQI? Will that process run parallel to 308? Do you intend to introduce it ahead of 308, or what's your general direction on timing?

Dr. Balsillie:

This is in here because the API is part of Regulation 308 as it existed. What we're saying is that, because it was in, it should have been discussed here. The recommendation is that the API would be left in as part of Regulation 308 and we heard concurrence with that over the speakers this afternoon. We have permission from management to go ahead with the AQI. This is a process which you know, Ron, has been in production for about two or three years. We have the computer in place. There are two things: there is an air quality telemetry system which allows us to bring in all the air quality data, or a large percentage of it, from across the province into our own facility in Toronto as well as to the regional offices so they have real-time data. That gives us the opportunity to publish the Air Quality Index. We have permission to proceed with the Air Quality Index. We're working now and we've got all the mechanics. What we need to do now is work on the communications plan: the education of the public and the media. We've heard a few things here about bringing some aspects of the AQI under the regulation. We've considered that, but I don't think we see that as a way to go. The Air Quality Index is more of an information system to let the people know the quality of the air. It's not designed as a regulatory tool. That's why it was considered to be left out of Regulation 308.

Supplementary by Ron.

Mr. Denning:

So you're going forward with the AQI with the currently defined compounds included in an Air Quality Index?

Dr. Balsillie:

That is the plan. Yes.

Mr. Denning:

And presumably this will start January 1, 1986.

Dr. Balsillie:

Well, no, it won't start January 1, 1986. We're still in the process of hooking up equipment, and getting it all physically in place will be a staged process because we can't do it all across the province at once. We'll start region-by-region and Lou, would we be looking at central region sometime in the spring?

Mr. Shenfeld:

The deadline to start in Toronto is March 1986.

Dr. Balsillie:

So they would be going from city to city introducing an education and communications package across the province in a step-wise fashion.

Mr. Denning:

Would the equations and the criteria upon which your AQI information — the numbers themselves will come together — be available to workshop participants now?

Dr. Balsillie:

Yes.

Mr. Denning:

So if we want copies of the latest ones we can have them?

Dr. Balsillie:

We'll make a note of that and attach them to the proceedings if you want us to do it that way.

Mr. Denning:

I'd like them sooner than that, please.

Dr. Balsillie:

How many people would like to see these equations? It's not a question of equations it's a matter of graphs. Okay, it seems to me we had better mail them out. We'll have a special mailing.

Mr. Denning:

That will include the rationale, will it?

Dr. Balsillie:

Yes. When you talk about equations, it is really a step-wise fashion based on existing air quality objectives and standards whether federal or Ontario.

Mr. Duncan:

As I've said before, this was a new step for us and we didn't really know how restrictive to be or how much guidance you wanted. We decided we would leave it as open as we could to get your feelings without any pre-conceived ideas, or at least as few as possible. I've had comments both ways. Some people think it was good, some people feel that it should have been more structured. I think it has been successful

and I hope you agree. I would like to thank all the participants for the effort they have put into it and we will have the proceedings put together and out by the end of January.

Dr. Balsillie:

I'd like to add my words to Chester's. One other point I keep wanting to make and I keep forgetting, I've got a little note here. If anyone gets back to the shop and is sitting down with absolutely nothing else to do because you only have 15-hour days if you wish to write on a scrap of paper and say, "listen, this just occurred to me", or "what about this", we're still open for the next three or four weeks if you wish to write in to Chester. Don't send in anything to me. Write to Chester if you have any further thoughts, or you can pick up the phone. We'd like to see it in writing though, because otherwise we might misinterpret what you say. I'd like to thank you for participating. You came here; you were open; you were frank. We've heard some strong messages and this has been exciting for us. We're all tired out because we gave our all. It's been a good process and I think we'll recommend it to others. So once again, thank you on behalf of the Ministry for coming. Thank you for participating and we will try and reciprocate by producing the proceedings, getting the information out and keeping you informed as the process develops. I hope you will come back again for information and feedback. We need it. This is what will make it work. Thank you very much. Have a good weekend.

Review of the Proceedings of Air Pollution General Regulation Workshop

Nov. 14th and 15th

The workshop held on November 14 and 15, 1985 at the Prince Hotel to discuss proposals for changes to O.Reg. 308, "General Air Pollution" was attended by 60 invitees. These people (see attached list) were chosen to present the views of numerous interests including major industries, various levels of government, the academic community, non-government organizations (interest groups), consultants, equipment suppliers, and the segment of the legal community, handling environmental concerns.

The format of the workshop (presented at the front of the document entitled Air Pollution General Regulation Workshop, November 1985) involved four concurrent working groups each composed of a representative cross-section of the various interests involved. These working groups (the membership of which was changed on the second day) reported to plenary sessions through a facilitator held at the conclusion of activities on both days. In addition, the Ministry made a presentation on the afternoon of November 14th on the modelling aspects of the work undertaken prior to the workshop. There was an evening reception on the 14th at which the Minister of the Environment, the Honourable James Bradley was the guest speaker.

In order to record input to the workshop, the plenary sessions, at which the group facilitators reported their groups' findings, and participants were invited to add their contributions, were taped. The edited transcription of these tapes is enclosed. To assist the facilitators in formulating their presentation, notes on workshop proceedings were prepared by recorders. The following summary has been prepared from the recorders' notes.

Use of Best Reasonable Technology and Ambient Air Modelling as a replacement for, or supplement, to Point of Impingement Standards and Ambient Guidelines

The basis upon which MOE should evaluate emissions to the atmosphere constituted a focal point for extensive discussions in all the working groups. Several participants emphasized the merits of the existing approach of Point of Impingement, although for the most part this support was tempered by admissions that there were also significant areas such as long range transport, dry and wet deposition and the treatment of hazardous emissions where this approach required modification. The proposed option of changing to Best Reasonable Technology, to ensure satisfactory bottom-of-the-stack controls on emissions, and ambient modelling was relatively well received but with a number of caveats, reflecting everything from a concern that the Ministry not "throw out the baby with the bathwater" to technical concerns over details of the modelling.

Participants in the workshops expressed considerable doubts over the definition of bottom-of-the-stack control being proposed and the methods by which Best Reasonable or Best Available Technology would be defined. They also presented a number of practical problems as to how changes to the legislation would be implemented:

- The phasing of the regulation,
- Concern over small operators,
- Disparities between Ontario and neighboring U.S. sources,
- Different levels of controls in different areas,
- Doubts over the soundness of the proposal as a basis for enforcement.

Some concern was also expressed on the technical aspects of using worst case modelling and it was strongly suggested that the Ministry undertake a detailed

examination of the practical impact of the proposals using selected case-studies. Considerable concern was also expressed that in dealing with toxic substances Best Reasonable Technology was inadequate and something akin to L.A.E.R. (Lowest Achievable Emission Rate) as used in the U.S., Best Available Technology, or a zero emission rate would be appropriate.

The Format of the Proposed Regulation

In formulating a revised regulation, MOE will be forced to examine whether or not to include details of the modelling. The issues discussed in this connection were the general ease with which industry and the courts should be able to interpret the regulation; the aspect of flexibility to change the modelling components as more advanced modelling becomes available; and the contrary point that the rules being applied should be firmly enshrined to permit consistent application. A strong plea was made by workshop attendees to make the regulation as simple as possible.

Standard Setting

Several participants at the workshop expressed the feeling that the standard setting process within the Air Resources Branch should be made more accessible to the public. The alternatives for greater public involvement which were discussed included better notice to the public on standard setting, more accessible documentation, and public hearings or some facility for public comment. In order to facilitate a more public format for standard setting it was suggested that there should be objectives established for various types of contaminants, but that public intervention should be allowed for in setting final numbers. It was further suggested that emission strategies could be tied to this process. The system of public hearings into health standards used by the

Ministry of Labour was held up by some participants as a possible model for Ministry of the Environment involvement. A number of discussants also indicated a need for regular review of standards, to ensure that they were based on most recent scientific information.

Certificates of Approval

Both the contents of Certificates of Approval, and the process by which they are issued, were critically reviewed by the discussion groups.

On the contents of C of A a wide range of opinion was expressed. Many attendees were in favor of retaining the existing format, but others were insistent that changes were required. Clearly, the existing format provides emitters with considerable latitude, but such latitude implies conscientious adherence. However, in terms of "fugitive emissions" and "housekeeping", several of the non-government organizations represented wanted greater specificity, although the method by which this should be achieved was not identified.

Two of the working groups talked about possible changes in the process of granting Certificates of Approval. Both proposed hearings, particularly for approvals involving significant impacts on the environment. One group appeared to favor public hearings for classes of Certificates of Approval. The other group indicated a preference for hearings at the discretion of the Director similar to those currently allowed in the case of certain waste management and waste disposal facilities (EPA Section 32(1)). Such hearings are considerably more open than those currently held before the Environmental Appeal Board (EPA Section 121) which are limited in scope and at which the public has no standing.

This same group also came up with the concept that perhaps a C of A should be a two-part document — the first being a C of A to construct, the second a C of A to operate, the latter to include process monitoring, compliance testing and reporting.

Opacity

On the question of opacity there appeared to be considerable support for the concept of using trained observers in lieu of smoke density charts, although there was some disagreement on details such as the frequency of personnel training and whether the public should be involved directly.

In two groups, the subject of whether C of A should permit certain exemptions to opacity requirements for start-up, disruptions, breakdowns, etc. was raised, as also was the requirement for different criteria for batch as opposed to continuous processes. The use of time-weighted averages, and a permitted number of violations emerged as suggested methods by which problems in these areas might be addressed. Discussants also grappled with the problems associated with the definition of unacceptable smoke densities and colored smoke plumes.

Air Quality Index

In all four discussion groups, concerns were expressed over the Ministry's plan to retain the Air Pollution Index as a regulatory tool while implementing the Air Quality Index as a public information service. The difficulty of having two parallel indices, the terminology involved, and the problems associated particularly with high AQIs due to contaminants such as ozone, to which the Ministry is unable to fully control, were identified by attendees as points of

possible confusion. In one group, after listening to an explanation of the legal reasons for not using the AQI as a control device in the regulation, participants suggested that it might be possible to utilize the framework of the existing regulation, together with the mechanics of the AQI, to include more parameters in the API. However, generally the concensus was that the API should be retained in its present form as a regulatory device while the AQI should become the prime public information index. All groups appeared to support a comprehensive public information package to overcome perceived difficulties of public acceptance. One group made a suggestion that rural AQI stations in southwest Ontario and northeast Ontario might be advantageous to provide background data on pollutants, such as ozone.

Phytotoxicology Guidelines

Considerable constructive criticism of the phytoxicology guidelines was expressed, particularly with regard to nomenclature and definitions. The concept of using the numbers was, however, generally supported and it was suggested that they might be incorporated in some way into the standard setting process.

Incineration

Support was expressed in the discussion groups for the creation of a separate guideline on incineration. One of the groups was particularly concerned with Section 12 and its applicability to apartment incinerators, particularly with respect to its effectiveness as a control mechanism. Another group expressed concern with the definitions of certain terms in the existing regulation, such as total, gaseous and particulate hydrocarbons. Destruction/removal efficiencies were also advocated by some representatives for inclusion in the regulation, particularly to deal with hazardous contaminants.

Open Burning

The subject of open burning was one in which participants appeared to favor municipal involvement using some type of model by-law approach. Railway ties were identified as being particularly troublesome.

Woodstoves

A strong need was identified by one of the groups for better regulation of woodstoves. The group examined possible forms of regulation, seeming to favor certification of designs. They also concluded that the subject required better documentation. The work being undertaken by Ryerson Polytechnical Institute for the Ministry was pointed out.

Future Direction of the Review Process

Each of the four groups, as requested, devoted some discussion to this topic.

Group I felt that following publication of these proceedings that there should be a 60 day review period by workshop participants and interested parties. This period would be followed by production of the draft regulation incorporating comments from the workshop and the review. The draft regulation would be circulated and following another review/comment period would be the subject of a public meeting of workshop participants and others. Following this meeting, the group felt that the regulation could be put into final form and gazetted.

Group II outlined a somewhat more detailed process and added a suggestion that a routine review of the legislation be undertaken every 3 to 5 years.

Following the workshop they recommended mailing out the proceedings, plus any written comments received, to all attendees, and to non-attendees requesting them. They then envisaged production of a document based on the Workshop and comments received which would provide the rationale, intended direction, implications and legal constraints involved in the revision process. This would again be circulated to the mailing list and 60 days allowed for comment. A public information process would then follow to increase awareness of the regulation. A draft regulation could then be written, together with draft EPA amendments. This would be followed by a 60 day comment period and a 30 to 60 day period to evaluate material gathered. A 30/60 day negotiation period would ensue followed by public hearings to resolve differences prior to finalization of the regulation.

Group III wanted a discussion paper based on the workshop including the various constraints and options available. Again following a 60 day review period they envisaged that a draft regulation would be produced followed by concurrent seminars on problem areas including modelling. Using these seminars plus written comments, the MOE would be able to go forward with the Regulation setting process in the Legislature.

Group IV, again after the publication of the workshop proceedings, envisaged a document outlining MOE's intended direction, their rationales and the implications of their proposals. This would be followed by input from interested parties in a set comment period and by concurrent public information sessions. The Ministry would then be responsible for drafting the regulation and amendments to the EPA and circulating them with a 60 day notice comment period. Following release of these draft documents the Ministry would convene a Public Hearing, Meetings, Open Houses or use a further comment period prior to proceeding with the publication of the Regulation.

Review of Documents Received Related to the Workshops

The Ministry has received 14 submissions related to the proceedings of the workshop as of January 31st, 1986. These submissions confirmed many of the viewpoints expressed at the workshop and made several suggestions about the methods by which the MOE might proceed.

1. Use of Best Reasonable Technology and Ambient Air Modelling as a Replacement for, or supplement to Point of Impingement Standards and Ambient Guidelines.

   The majority of correspondents have indicated that they favor some changes in the modelling provisions of the existing O.Reg 308, and the adoption of emission standards based on best reasonable technology. However, some concerns with the approach have been articulated namely:

   1. The use of worst case modelling for C of A is inappropriate and unduly restrictive.

   2. Some of the modelling details were questioned. The setting up of a modelling workshop was advocated.

   3. The existing P of I process provides considerable flexibility, particularly with respect to small sources — some correspondents felt it would be appropriate to retain a modified P of I approach particularly for small local sources of non-toxic contaminants. One correspondent suggested that the existing system implied Best Practicable Technology and that Point of Impingement was supplementary to this.

   4. That L.A.E.R. should be considered as BRT in the case of toxics. This implies different levels of control for different contaminants according to needs.

5. The implications of the proposed changes require identifying, particularly where they will be affecting local economies. One correspondent suggested BRT will require a geographic component if it is to be implemented without causing severe economic affects.

6. Attempts should be made to make Ontario standards comparable with those in U.S.

7. The methodology for setting BRT standards should include public input.

8. More vigorous monitoring will be required.

9. Best Reasonable Technology should only be required if a need can be demonstrated.

10. A separate regulation should be considered to handle long range transport aspects.

2. Certificates of Approval

Comments received on the C of A process have re-iterated views expressed at the workshop - viz.

1. Some capability to deal with batch as opposed to continuous processes needs to be incorporated in the regulation.

2. A joint (or separate) certificate to construct and operate should be seriously considered.

3. The process should be more open to public input particularly in the case of large projects. The Part V hearing mechanism used for waste management sites was suggested as a model in that it specifies circumstances under which mandatory hearings are to be held, and permits director's discretion under other circumstances.

4. Regular reviews of C of A should be undertaken to check on compliance.

3. API/AQI

The reservations expressed by participants at the workshop on the simulataneous use of the AQI and the API have been re-iterated in the correspondence. The following points have been raised.

1. Consideration should be given to including parameters other than SO_2 and particulate in the API framework only if there is a demonstrated relationship to human health.

2. Consideration should be given to increasing the number of parameters in the API and modifying the formulae.

3. A rural station should be established in southwestern Ontario to document levels of such pollutants as ozone to put measurements from urban areas into context.

4. Phytotoxicology Guidelines

It was noted by one correspondent that some of the elements included in these guidelines are actually beneficial to plant growth. The same correspondent observed that no organic chemical data were included in the list and questioned the propriety of combining data from samples taken across the province to generate a single urban or rural number for regulatory purposes for use on a regional basis.

5. Open Burning

A participant at the Workshop noted that open burning at landfills should be banned.

6. Review Process

Several comments have been received on the process which should be followed in updating O.Reg. 308 both in the short and long term. Generally these were supportive of what the MOE is currently proposing. One organization which supplied detailed comments on this subject stated a specific preference for a standby committee on regulatory reform; a public regulation docket providing information on proposed changes to the regulation; and in the present context a green paper, followed by a judicial review to resolve critical aspects. Others also identified the need for a periodic review of the regulation in general, and of the standards, the standard setting process and the rationales. In connection with the latter a strong request was made for the MOE to publish its rationale documents along with the proceedings of the workshop.

The Ministry's Timetable For Review of O.Reg 308

After examining the working group proposals and correspondents' comments the following program has been evolved. Attempts have been made to incorporate as many of these suggestions as practically possible.

1. Workshop
2. Production of proceedings and covering document summarizing positions taken on various topics at the workshop and the subject matter of subsequent correspondence
3. Comment period

4. Production of a document by MOE identifying rationale, directions, and implications of proposals
5. Circulation of rationale document to mailing list with a 60 day comment period
6. Production of draft regulation
7. Circulation of draft regulation to mailing list with a 60 day comment period
8. Discussions with Head Office and Regional Staff on the proposed regulation
9. Public meetings to discuss proposed regulation
10. Revision of regulation
11. Production of Final Draft Regulation
12. Send Regulation to Legislative Counsel for processing.

It is anticipated that this process will be completed by the end of April 1987.

THE HONOURABLE JIM BRADLEY
MINISTER OF THE ENVIRONMENT

NOTES FOR REMARKS

TO THE

AIR POLLUTION
GENERAL REGULATION WORKSHOP

NOVEMBER 14, 1985
(CHECK AGAINST DELIVERY)

IT IS MY GREAT PLEASURE TO WELCOME YOU TO THIS WORKSHOP AND FORUM TO REVIEW THE REGULATION FOR GENERAL AIR POLLUTION FOR THE PROVINCE OF ONTARIO, REGULATION 308.

EARLY IN 1983, THE ENVIRONMENT MINISTRY BEGAN A REVIEW OF OUR AIR MANAGEMENT PROGRAM. ITS PURPOSE WAS TO REVIEW AND UPDATE MINISTRY GUIDELINES AND POLICIES TO ENSURE BETTER MANAGEMENT OF THE QUALITY OF THE AIR IN THE PROVINCE OF ONTARIO.

MY CONCERN, AND THE CONCERN OF THE PUBLIC, IS THAT WE CONTINUE TO STRIVE TO OFFER THE PEOPLE OF ONTARIO THE VERY BEST IN AIR QUALITY AND GENERAL ENVIRONMENTAL PROTECTION.

THAT IS WHY I HAVE BEGUN THIS INTENSIVE REVIEW OF REGULATION 308, OUR MAJOR AIR QUALITY REGULATION, WHICH SETS OUT POINT OF IMPINGEMENT STANDARDS FOR A FULL RANGE OF AIRBORNE CONTAMINANTS.

IN THE RECENT PAST, MANY OF THE INITIATIVES, NEW POLICIES, AND PROGRAMS IN WASTE MANAGEMENT WERE REFINED BY CONSULTING AND WORKING WITH PROFESSIONAL GROUPS LIKE YOURSELVES.

TONIGHT, I WOULD LIKE TO STRESS VERY STRONGLY THAT MY STAFF AND I APPRECIATE WORKING WITH YOU ON THIS IMPORTANT SUBJECT, REAPING THE BENEFITS OF YOUR IDEAS, YOUR OPINIONS AND YOUR CANDOUR.

I WOULD ALSO LIKE TO EMPHASIZE THAT THIS IS JUST A BEGINNING. WE ARE CONCERNED WITH DEVELOPING A REGULATION WHICH SETS NEW, MORE APPROPRIATE STANDARDS TO ENSURE THAT WE CONTINUE TO MAINTAIN A HIGH STANDARD OF AIR QUALITY. WE ARE ALSO INTERESTED IN ENSURING THAT WE HAVE A REGULATION WHICH IS REALISTIC AND WORKABLE.

WE IN ONTARIO TRADITIONALLY TAKE PRIDE IN BEING LEADERS IN ENVIRONMENTAL PROTECTION.

THE GENERAL AIR QUALITY PROGRAM CAME INTO OPERATION IN 1968. SINCE THEN, IT HAS CONCERNED ITSELF WITH THE DETAILED INSPECTION AND INVENTORYING OF POTENTIAL SOURCES OF AIR EMISSIONS ACROSS THE PROVINCE. THE MINISTRY MONITORS A WIDE RANGE OF CONTAMINANTS IN LITERALLY THOUSANDS OF ONTARIO LOCATIONS, AND IN SOME CASES, THIS WORK HAS BEEN SUPPLEMENTED BY VOLUNTARY OR REQUIRED MONITORING BY INDUSTRY.

THE MINISTRY ALSO WORKS WITH INDUSTRY AND MUNICIPALITIES TO DEVELOP PROGRAMS TO MODERNIZE EQUIPMENT, INSTALL CONTROLS, AND UPGRADE HOUSEKEEPING OPERATIONS SO THAT POLLUTION DISCHARGES CAN BE MINIMIZED. THERE ARE BOTH NEGOTIATED PROGRAMS AND FORMAL REQUIREMENTS SET OUT IN CONTROL ORDERS AND SPECIFIC REGULATIONS.

THESE PROGRAMS HAVE PRODUCED TANGIBLE RESULTS.

SINCE 1970, THE ATMOSPHERIC LEVELS OF SULPHUR DIOXIDE IN DOWNTOWN TORONTO HAVE BEEN REDUCED BY 94 PER CENT. CARBON MONOXIDE HAS BEEN DECREASED BY 56 PER CENT. SUSPENDED PARTICULATE LEVELS IN THE SAME PERIOD HAVE DROPPED 50 PER CENT.

IN HAMILTON, SUSPENDED PARTICULATE MATTER, THE AREA'S MAJOR POLLUTANT, HAS DECREASED 58 PER CENT, MAINLY AS A RESULT OF THE ABATEMENT OF EMISSIONS BY THE STEEL INDUSTRY. THE HIGHEST DEGREES OF IMPROVEMENT WERE OBTAINED CLOSEST TO THE STEEL PLANTS.

IN SUDBURY, SARNIA AND WINDSOR, AIR POLLUTION CONTROL PROGRAMS HAVE ELIMINATED 75 TO 80 PER CENT OF THE AIRBORNE SULPHUR DIOXIDE FROM THE AIR OF THESE CITIES.

THE IMPLEMENTATION OF THESE PROGRAMS IS A LONG AND GRADUAL PROCESS AND THE END RESULTS DO NOT COME QUICKLY.

AND IT COSTS MONEY. AIR QUALITY IN ONTARIO HAS REQUIRED AN ESTIMATED $3 BILLION IN INDUSTRIAL SPENDING ON POLLUTION CONTROL EQUIPMENT.

BUT IT HAS BEEN WELL WORTH IT.

WHILE IT IS TRUE THAT OVER THE LAST FIFTEEN YEARS ONTARIO HAS AN IMPRESSIVE RECORD OF AIR POLLUTION CONTROL, IN OPPOSITION, I BECAME CONCERNED THAT THERE WAS A PERCEPTIBLE LOSS OF MOMENTUM IN THIS PROGRESS.

AS MINISTER, I CAN ASSURE YOU THAT A QUALITY ENVIRONMENT IS A PRIORITY FOR THE PETERSON GOVERNMENT AND I AM DETERMINED TO SEE THAT THIS RECORD OF ACHIEVEMENT IS MAINTAINED AND IMPROVED.

WE NEED TO CHANGE OUR AIR MANAGEMENT PHILOSOPHY IN ORDER TO BE RELEVANT TO THE NEEDS OF THESE PRESENT TIMES. OUR AIR QUALITY REGULATION MUST BE EFFECTIVE, ACCURATE AND FAR REACHING, AND ABOVE ALL, IT MUST BE APPROPRIATE AND UP TO DATE.

THE PHILOSOPHY BUILT INTO THE ORIGINAL REGULATION 308 WAS A PHILOSOPHY OF THE LATE 60s AND EARLY 70s. THE SO-CALLED POINT OF IMPINGEMENT APPROACH WAS FAVORED. IT WAS A PHILOSOPHY OF EFFECT. IT TOOK INTO ACCOUNT THE TRANSPORTATION AND DISPERSION OF EMISSIONS FROM THE SOURCE.

IN THOSE DAYS, IT WAS A FAIR APPROACH TO POLLUTION CONTROL, FAIR TO INDUSTRY AND FAIR TO THE PEOPLE OF ONTARIO. AS I'VE ALREADY INDICATED, IT PRODUCED SOME VERY POSITIVE RESULTS.

BUT IT OFFERS OUR ENVIRONMENT NO PROTECTION AGAINST LONG-RANGE TRANSPORTATION OF AIR POLLUTANTS OR LONG-TERM DEPOSITION OF CONTAMINANTS FROM THE AIR. NOR DOES IT RECOGNIZE THE PROBLEM OF FUGITIVE EMISSIONS FROM PLANT AREAS, LIKE COAL PILES OR ROAD DUST. THE PRESENT REGULATION 308 ALSO FAILS TO ADEQUATELY DEAL WITH THE EMISSION INTO THE ENVIRONMENT OF A HOST OF COMPLEX ORGANIC CHEMICALS.

ON THE PRACTICAL SIDE, THE POINT OF IMPINGEMENT PHILOSOPHY WAS THE CENTRAL FEATURE TO THE CRITERIA AVAILABLE TO THE MINISTRY FOR GRANTING CERTIFICATES OF APPROVAL FOR THE CONSTRUCTION OF PLANTS IN THE PROVINCE.

IN OTHER WORDS, DEPENDING ON THE RESULTS OF THE CALCULATION OF THE CONCENTRATION AT THE POINT OF IMPINGEMENT PERMISSION WOULD OR WOULD NOT BE GRANTED. ONCE BUILT, HOWEVER, AN INDUSTRY'S EMISSIONS ENTERED THE REAL WORLD AND FURTHER CONTROLS WERE SOMETIMES REQUIRED FOR THE PROTECTION OF THE COMMUNITY.

IN THE LAST 20 YEARS, RESEARCH HAS GIVEN US A MUCH MORE SCIENTIFIC AND ACCURATE UNDERSTANDING OF THE CAUSES AND EFFECTS OF AIR POLLUTION. ADVANCES HAVE BEEN ALSO MADE IN THE TECHNOLOGY OF POLLUTION CONTROL. WE HAVE DEVELOPED COMPUTERIZED MODELS WHICH ARE MORE SOPHISTICATED AND MORE APPROPRIATE TO TACKLE OUR CURRENT POLLUTION PROBLEMS. THESE ARE MODELS WHICH HAVE BEEN TRIED AND TESTED IN THE FIELD. THESE MODELS ARE CAPABLE OF COPING WITH LOCAL CONDITIONS SUCH AS TOPOGRAPHY, METEOROLOGY AND LAND USE.

IN ADDITION, LONG-RANGE TRANSPORT OF CONTAMINANTS SUCH AS ACID RAIN, TOXIC CHEMICALS, AND OZONE HAS BECOME A PROMINENT ISSUE OF OUR TIMES. IT IS A THREAT TO THE INTEGRITY OF OUR ENVIRONMENT. THIS, AS YOU KNOW IS AN INTERNATIONAL PROBLEM, BUT WE IN ONTARIO MUST CONTINUE WORK TO DECREASE THE PROVINCE'S CONTRIBUTION TO ACID RAIN, AND WE WILL.

ALSO, WE HOPE TO BROADEN THE SCOPE AND THE TERMS OF REFERENCE FOR THE CERTIFICATES OF APPROVAL ISSUED TO INDUSTRY BY THE MINISTRY. NOT ONLY SHOULD THEY COVER PROPER PLANT CONSTRUCTION, BUT THEY SHOULD ALSO REQUIRE THE SATISFACTORY MAINTENANCE OF EQUIPMENT FOR POLLUTION CONTROL, AND RECORDS RELATING TO THEIR OPERATION AND REPAIR MUST BE KEPT UP TO DATE. THESE ARE SOME OF THE ASPECTS YOU WILL BE DEALING WITH IN THIS WORKSHOP.

FROM MY PERSPECTIVE, THE DAYS OF USING THE AIR AS AN UNBOUNDED WASTE DISPOSAL SITE ARE RAPIDLY COMING TO AN END. OUR STACKS ARE, IN EFFECT, WASTE DISPOSAL SYSTEMS AND WE HAVE TO PROVIDE A BETTER AND TOUGHER REGULATORY FRAMEWORK TO DEAL WITH THAT FACT. THE ENVIRONMENT AND PUBLIC HEALTH ARE AT STAKE.

THE FINAL REGULATION TO BE DEVELOPED, WHICH WILL INCLUDE YOUR INPUT, WILL BE AN EFFECTIVE WORKING TOOL FOR THE NEXT DECADE IN A COMPREHENSIVE PROGRAM OF AIR MANAGEMENT. THERE ARE OTHER IMPORTANT COMPONENTS IN THIS PROGRAM. THE MINISTRY HAS DEVELOPED AND DEPLOYED A WIDE RANGE OF SOPHISTICATED INSTRUMENTS FOR THE COLLECTION OF AIR QUALITY DATA THROUGHOUT OUR SIX REGIONS IN ONTARIO.

OVER THE NEXT YEAR, FOR MORE THAN 20 URBAN COMMUNITIES ACROSS ONTARIO, WE WILL BE INTRODUCING A NEW AIR QUALITY INDEX RELATED TO SIX AIR POLLUTANTS. THESE ARE SULPHUR DIOXIDE, PARTICULATE, CARBON MONOXIDE, OZONE, NITROGEN DIOXIDE, AND TOTAL REDUCED SULPHUR. THIS IS A MORE SOPHISTICATED INFORMATION SYSTEM FOR URBAN AIR QUALITY WHICH WILL INCLUDE AS ONE ELEMENT THE PRESENT AIR POLLUTION INDEX AND ALERT SYSTEM THAT HAS SERVED ONTARIO WELL FOR THE PAST FIFTEEN YEARS AS INDICATED BY THE DOWNWARD TREND OF THE NUMBER OF OCCASIONS WHEN THE API EXCEEDED 32. REFERRING TO TORONTO THE NUMBER OF OCCURRENCES EXCEEDING 32 HAS STEADILY DECREASED FROM 19 IN 1970 TO AN AVERAGE OF TWO IN RECENT YEARS.

THE NEW AIR QUALITY INDEX WILL BETTER INFORM OUR CITIZENS ON THE QUALITY OF THEIR AIR AND ANY CHANGE IN ITS CONDITION, IN A MORE TIMELY FASHION.

IN ADDITION, OUR MINISTRY INSPECTORS WORKING IN THE REGIONS OF THE PROVINCE ARE MORE EQUIPPED NOW THAN EVER BEFORE TO TELL US EXACTLY WHAT IS OUT THERE.

ADD TO THESE ASSETS A PROGRAM OF DETERMINED AND CONSISTENT ENFORCEMENT. ONTARIO HAS A TRADITION OF GOOD ENVIRONMENTAL LEGISLATION. THE SPIRIT OF THIS LEGISLATION REFLECTS THE CONCERNS AND PRIORITIES OF THE PEOPLE OF ONTARIO.

OVER THE PAST FIFTEEN YEARS, THE IMPACT OF ONCE APPROPRIATE PENALTIES HAS DIMINISHED TO THE POINT WHERE THEY ARE SOMETIMES NO MORE THAN A SLAP ON THE WRIST.

ESPECIALLY TO THE LARGE SCALE INDUSTRIAL POLLUTER.

I INTEND TO MAKE SURE THAT OUR LAWS AND REGULATIONS ARE ENFORCED FIRMLY, FAIRLY AND TO THE BENEFIT OF EVERYONE AND TO ENSURE THAT ADEQUATE PENALTIES ARE PROVIDED FOR VIOLATION.

ENVIRONMENTAL PROTECTION MUST SAFEGUARD THE RIGHTS OF PEOPLE TO OCCUPY AND ENJOY THEIR ENVIRONMENT IN HEALTH AND SAFETY.

THESE ARE SOME OF THE OTHER ELEMENTS OF THE FRAMEWORK IN WHICH YOUR EFFORTS IN THIS WORKSHOP FIT. WE'VE INVITED YOU TO HELP MAKE OUR MAJOR AIR QUALITY REGULATION, REGULATION 308, COMPATIBLE WITH THE DEMANDS AND STANDARDS OF THE 80s AND THE ENVIRONMENTAL PHILOSOPHY OF OUR NEW GOVERNMENT. WE MUST ENSURE THAT IT REFLECTS THE LATEST AND BEST KNOWLEDGE AND TECHNOLOGY IN POLLUTION CONTROL AND ENVIRONMENT PROTECTION.

ALL OF YOU HAVE SPECIAL INSIGHT TO OFFER AND EXPERTISE IN KEY AREAS. IT IS IMPORTANT TO US THAT WE HAVE THE VIEWPOINT OF THOSE WHO WILL HAVE TO ABIDE BY THIS REGULATION, THOSE WHOSE CONCERN IS THE PUBLIC AND THE ENVIRONMENT IT IS DESIGNED TO PROTECT AND THOSE WHO MUST WORK WITH AND APPLY IT.

I CAN ASSURE YOU THAT OUR GOVERNMENT LOOKS FORWARD TO AND VALUES THE CONTRIBUTIONS YOU CAN MAKE TO THE IMPROVEMENT OF THIS VITAL PORTION OF OUR LEGISLATION.

ON THIS NOTE, I WILL CLOSE AND LEAVE YOU TO CONTINUE YOUR WORK.

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AIR POLLUTION GENERAL REGULATION WORKSHOP

Nov. 14/15th 1985

LIST OF PARTICIPANTS

NAME	AFFILIATION
E. Alp	Concord Scientific Corporation
E. Baldock	Metropolitan Toronto Public Works
S. Barton	Ontario Research Foundation
B. Bell	Inco Limited
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R. Cameron	Ontario Petroleum Association: Texaco Canada Limited
C.B. Caswell	Petrosar Incorporated
C. Chisamore	Ontario Ministry of Energy
R. Cooke	Ontario Forest Industries Association: E.B. Eddy
R. Cotton	Canadian Bar Association: McCarthy and McCarthy
H. Dahme	David Estrin Barristers and Solicitors
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